18 Skates and rays in the Celtic Seas (ICES subareas 6 and 7 (except Division 7.d))

Advice for stocks in this ecoregion was last provided in 2020 and will next be provided in 2022. Therefore, this chapter only contains minor edits and updates to landings tables and figures. The advice for 2021 and 2022 is reproduced in Section 18.2.3.

18.1 Ecoregion and stock boundaries

See Stock Annex.

18.2 The fishery

18.2.1 History of the fishery

See Stock Annex.

18.2.2 The fishery in 2020

Although so far unquantified, COVID-19 is expected to have affected fishing activity in 2020, with national or local restrictions on fishing activity reducing fishing effort for at least some of the year.

TAC and quota regulations were restrictive or near-restrictive for most nations and fisheries. The inclusion of common skate (*Dipturus batis*-complex) on the prohibited species list has resulted in increased discarding or misreporting of this species, especially in areas where they are locally common.

18.2.3 ICES advice applicable

ICES provided advice for several species/stocks in this region in 2020 as summarized in Table below.

Stock	Stock code	Assessment category	Advice basis	Advised Landings in 2021 and 2022
Blonde ray *Raja brachyura* Divisions 7.a and 7.f-g	rjh.27.7afg	5.	Precautionary approach	716 t
Blonde ray *Raja brachyura* Division 7.e	rjh.27.7e	5.	Precautionary approach	266 t
Thornback ray *Raja clavata* Subarea 6	rjc.27.6	3	Precautionary approach	137 t
Thornback ray *Raja clavata* Divisions 7.a and 7.f-g	rjc.27.7afg	3	Precautionary approach	1663 t
Thornback ray *Raja clavata* Division 7.e	rjc.27.7e	5	Precautionary approach	212 t
Small-eyed ray *Raja microocellata* Bristol Channel (Divisions 7.f-g)	rje.27.7fg	3	Precautionary approach	123 t

Stock	Stock code	Assessment category	Advice basis	Advised Landings in 2021 and 2022
Small-eyed ray *Raja microocellata* English Channel (Divisions 7.d-e)	rje.27.7de	5	Precautionary approach	40 t
Spotted ray *Raja montagui* Subarea 6 and Divisions 7.b and 7.j	rjm.27.67bj	3	Precautionary approach	51 t
Spotted ray *Raja montagui* Divisions 7.a and 7.e-h	rjm.27.7ae-h	3	Precautionary approach	1033 t
Cuckoo ray *Leucoraja naevus* Subareas 6–7 and Divisions 8.a-b and 8.d	rjn.27.678abd	3	Precautionary approach	3150 t
Sandy ray *Leucoraja circularis* Celtic Seas and adjacent areas	rji.27.67	5	Precautionary approach	34 t
Shagreen ray *Leucoraja fullonica* Celtic Seas and adjacent areas	rjf.27.67	5	Precautionary approach	168 t
Undulate ray *Raja undulata* Divisions 7.b and 7.j	rju.27.7bj	6	Precautionary approach	zero
Undulate ray *Raja undulata* Divisions 7.d-e (English Channel)	rju.27.7de	3	Precautionary approach.	183 t
Common skate *Dipturus batis*-complex (flapper skate *Dipturus intermedius* and blue skate *Dipturus batis*) Subarea 6 and Divisions 7.a–c and 7.e–j	rjb.27.67a-ce-k	6	ICES was not requested to provide advice on fishing opportunities for these stocks.	NA
White skate *Rostroraja alba* in the northeast Atlantic	rja.27.nea	6	Precautionary approach	zero
Other skates Subarea 6 and Divisions 7.a–c and 7.e–j	raj.27.67a-ce-h	6	Insufficient data to provide advice	NA

18.2.4 Management applicable

A TAC for skates in Subarea 6 and divisions 7.a–c and 7.e–k was first established for 2009 and set at 15 748 t. Since then, the TAC has been reduced by approximately 15% (in 2010), 15% (in 2011), 13% (in 2012), 10% (in 2013) and a further 10% (in 2014). In 2017, the TAC was increased by 5%, (including separate TAC for *R. microocellata*), and in 2018, this was increased by a further 15% (including separate TAC for *R. microocellata* and *R. undulata*). In 2020, the TAC was set and reset because of negotiations between the UK and the EU. In April 2021, the TAC was set at 3882 tonnes, excluding an as yet to-be-determined UK quota. In June 2020, an agreement was reached between the EU and UK. The figures below refer to this agreement.

The history of the regulations are as follows:

Year	TAC for EC waters of 6a-b and 7a–c, and 7.e–k	Other measures	Regulation
2009	15 748 t	1,2	Council Regulation (EC) No. 43/2009 of 16 January 2009
2010	13 387 t	1,2,3	Council Regulation (EU) No. 23/2010 of 14 January 2010
2011	11 379 t	1,2,3	Council Regulation (EU) No. 57/2011 of 18 January 2011
2012	9915 t	1,2,3	Council Regulation (EU) No. 43/2012 of 17 January 2012
2013	8924 t	1,2,3	Council Regulation (EU) No. 39/2013 of 21 January 2013
2014	8032 t	1,3,4	Council Regulation (EU) No. 43/2014 of 20 January 2014
2015	8032 t	1,3,5	Council Regulation (EU) No. 2015/104 of 19 January 2015, and amended in Council Regulation (EU) No. 2015/523 of 25 March 2015
2016	8032 t	1,3,6,7	Council Regulation (EU) No 2016/72 of 22 January 2016, and amended in Council Regulation (EU) No. 2016/458 of 30 March 2016
2017	8434 t	1,3,6,8	Council Regulation (EU) No 2017/127 of 20 January 2017,
2018	9699 t	1,3,6,8,9	Council Regulation (EU) No 2018/120 of 23 January 2018,
2019	10 184 t	1,3,6,7,10,11	Council Regulation (EU) No 2019/124 of 30 January 2019,
2020	10 184 t	1,3,6,7,10,11	Council Regulation (EU) No 2020/123 of 27 January 2020
2021	9,675 t	1,3,6,7,10,11,12,13	Council Regulation (EU) No 2021/703 of 26 April 2021, amending Council Regulations 2021/91 and 2021/92 and Written record of fisheries consultations between the United Kingdom and the European Union for 2021

[1] Catches of cuckoo ray *L. naevus*, thornback ray *R. clavata*, blonde ray *R. brachyura*, spotted ray *R. montagui*, small-eyed ray *R. microocellata* sandy ray *L. circularis*, shagreen ray *L. fullonica* should be reported separately.
[2] Does not apply to undulate ray *R. undulata*, common skate *D. batis*, Norwegian skate *D. nidarosiensis* and white skate *Rostroraja alba*. Catches of these species may not be retained on board and shall be promptly released unharmed to the extent practicable. Fishers shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species.
[3] Of which up to 5% may be fished in EU waters of Division 7.d.
[4] Shall not apply to undulate ray *R. undulata*, common skate *D. batis* complex, Norwegian skate *D. nidarosiensis* and white skate *Rostroraja alba*. When accidentally caught, these species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species.

[5] Shall not apply to undulate ray *Raja undulata*. This species shall not be targeted in the areas covered by this TAC. Bycatch of undulate ray in area 7.e exclusively may be landed provided that it does not comprise more than 20 kg live weight per fishing trip and remain under the quotas shown [TAC = 100 t]. This provision shall not apply for catches subject to the landing obligation.
[6] Shall not apply to small-eyed ray *R. microocellata*, except in Union waters of 7.f and 7.g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7.f and 7.g provided below may be taken [TAC = 188 t]
[7] Shall not apply to undulate ray *R. undulata*. This species shall not be targeted in the areas covered by this TAC. In cases where it is not subject to the landing obligation, bycatch of undulate ray in area 7.e may only be landed whole or gutted, and provided that it does not comprise more than 40 kilograms live weight per fishing trip. The catches shall remain under the quotas shown [TAC = 100 t]. Bycatch of undulate ray shall be reported separately under the following code: RJU/67AKXD.
[8] Shall not apply to undulate ray *R. undulata*. This species shall not be targeted in the areas covered by this TAC. In cases where it is not subject to the landing obligation, bycatch of undulate ray in area 7.e may only be landed whole or gutted. The catches shall remain under the quotas shown [TAC = 161 t]. Bycatch of undulate ray shall be reported separately under the following code: RJU/67AKXD (2017) RJU/07E (2018).
[9] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 154 t].
[10] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 192 t].
[11] Shall not apply to undulate ray (*Raja undulata*).

[12] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 123 t].
[**13]** Special condition: of which up to 5 % may be fished in Union waters of 7d (SRX/*07D.), without prejudice to the prohibitions set out in Articles 20 and 57 of the EU TAC and Quota Regulation 2021 and relevant prohibitions in UK law for the areas specified therein. Catches of cuckoo ray (Leucoraja naevus) (RJN/*07D.), thornback ray (Raja clavata) (RJC/*07D.), blonde ray (Raja brachyura) (RJH/*07D.), spotted ray (Raja montagui) (RJM/*07D.), sandy ray (Raja circularis) (RJI/*07D.) and shagreen ray (Raja fullonica) (RJF/*07D.) shall be reported separately. This special condition shall not apply to small-eyed ray (Raja microocellata) and undulate ray (Raja undulata).

Raja microocellata in Union waters of Subarea 6 and divisions 7.a–c and 7.e–k were initially subject to strict restrictions at the start of 2016, with Council Regulation (EU) 2016/72 of 22 January 2016 stating that: "*When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species*". However, this was subsequently updated in Council Regulation (EU) 2016/458 of 30 March 2016, whereby the prohibition in landings was revoked for Union waters of 7.f–g, with a precautionary TAC of 188 t being set for this species, within the total skate and ray quota.

A sub TAC of 154 t was similarly applied in 2017 and in 2018, while this was set at 192 t for 2019 and 2020. In 2021, this was set at 123 t.

It is forbidden to retain skates and rays caught on the Porcupine Bank from 1 May–31 May.

There are also mesh-size regulations for target fisheries, the EC action plan for the conservation and management of sharks (EC, 2009), and some local bylaws and initiatives, which were detailed in ICES (2010).

18.2.5 Other management issues

The requirement for EU negotiations with the UK for the first time in 2020/2021 meant that final TAC agreements were not complete at the time by mid-June 2021.

A high-survivability exemption to the Landings Obligation was provided for skates and rays in the Celtic Seas ecoregion until 31 December 2021, with *L. naevus* only exempted until 31 December 2019. An extension to the exemption would only be possible with additional supporting information being provided by the NWWAC. This particularly applies to *L. naevus*, which had a shorter deadline for the provision of evidence of high-survivability than the other species. Several meetings have been held by the NWWAC to discuss and advance this. Best practice guides and measures have been circulated to NWWAC members (2020). The *L. naevus* exemption has been extended to 21 December 2022.

Alternatives to the current TAC system are being explored by the European Commission. A meeting to set Terms of Reference for an STECF request to propose alternatives was held in May 2017. This follows on from proposals by the NWWAC.

Fishermen off North Devon have a voluntary seasonal closed area over what they consider to be a nursery ground.

There are several French measures designed to regulate fishing for *R. undulata* in the English Channel (7.d and 7.e). These measures include: trip limits, closed seasons, restricted licensing of vessels and in 2017 a minimum size of 78 cm (described in Gadenne, 2017, WD).

18.3 Catch data

A data-call in 2017 again followed the procedures recommended by WKSHARK2 (ICES, 2016). This meeting had recommended that recent landings of all elasmobranch species be resubmitted by all ICES members. These landings would be re-evaluated, and declared landings from unlikely locations or species be reassessed or reassigned as required. Decision trees on how to treat problematic records were provided in the workshop report. An ICES data call was issued following this meeting requesting all elasmobranch landings from 2005–2015. The 2017 data call requested a resubmission of final 2015 and preliminary 2016 landings data.

These data were examined by WGEF prior to and during WGEF 2016. Tables 18.1 and 18.2 provides the re-assessed landings by stock for this ecoregion. Some data were resubmitted in 2017, therefore there may be slight differences in landings figures between this and previous reports.

The 2018 and 2019 data calls followed the procedures above.

In 2020, data were provided by means of the ICES InterCatch system for the first time. Further details can be found in Section 1. Intercatch was again used in 2021.

18.3.1 Landings

Landings data for skates (Rajidae) were supplied by all nations fishing in shelf waters within this ecoregion. Data for 2020 are considered provisional. Landings data prior to 2005 are considered variable and uncertain.

Landings by nation are given in Table 18.1. Landings for the entire time-series are shown in Figure 18.1a–c. Where species-specific landings have been provided they have also been included in the total for the relevant year. Although historically there have been around 15 nations involved in the skate fisheries in this ecoregion, only five (France, Great Britain, Belgium, Ireland, and Spain) have continually landed large quantities.

Landings are highly variable, with lows of approximately 14 000 t in the mid-1970s and 1990s, and highs of just over 20 000 t in the early and late 1980s and late 1990s. Although landings have fluctuated over most of the time-series, there has been a steady decline in landings since 2000, at least partly due to the introduction of catch limits. Annual reported landings were less than 10 000 t from 2009–2018, (noting that the TAC was established in 2009). Landings rose above 10 000 t in 2019, for the first time since the TAC was introduced.

West of Scotland (Division 6.a)

Average landings in the early 1990s were about 3000 t. Landings were less than 500 t from 2009–2016, but have been over 500 t per year since then.

Rockall (Division 6.b)

Reported landings from Rockall in the 1990s were about 500 t per year, but have been generally under 200 t since 2009, and less than 100 t in recent years. An exception to this was in 2019 when Norwegian longliners reported 248 t of rays from this area.

The increased landings in the mid-1990s were a result of new landings of 300–400 t per year by Spanish vessels. These no longer appear to take place since only limited Spanish landings have been reported in this area in recent years. It is not clear what proportion of these catches may have been taken from Hatton Bank (6.b.1 and 12.b). One to three Russian longliners fished in this area in 2008–2009, mainly catching deep-water species, including sharks, but also catching 7 t of deep-water skate species.

Irish Sea (Division 7.a)

Reported landings in the Irish Sea vary considerably, and ranged from over 1500 t in 1995 to ca. 5000 t in the late 1980s. Since 2006, annual landings have been < 2000 t, and are now at a low level, although landings began increasing in 2018. The initial decline may be as a result of reduced fishing effort and effort changes because of the cod recovery programme in the area, where whitefish boats have switched to *Nephrops* fishing, with the latter thought to have a lower skate bycatch. Most landings are from Ireland, Great Britain and Belgium.

Bristol Channel (Division 7.f)

Following an increase in reported landings in the mid-1970s, skate landings in Division 7.f have been under 1300 t over the last decade. Landings are predominantly from three countries (Great Britain, France and Belgium).

Western English Channel, Celtic Sea and west of Ireland (divisions 7.b–c, 7.e and 7.g–k)

Landings of skates and rays from divisions 7.b–c, 7.e and 7.g–k estimated by WGEF decreased from 10 000 t in 2005 to 5000 in 2013 and then increased to 6000 in 2019. In 2020, ICES estimated landings were 5100 t, the decrease from 2019 to 2020 may be the consequence of the COVID-19 pandemic.

18.3.2 Skate landing categories

Historically, most skate landings were reported under a generic landing category. There has been a legal requirement to report most skate landings to species level throughout this ecoregion since 2010. On average, 99% of the 2019 landings were reported to species level, with a continuous decline in landings declared in generic categories since 2011. Earlier reports have highlighted various issues regarding the quality of these data (ICES, 2010; 2011; 2012), and this is further discussed in Section 18.4.3.

A study by Silva *et al.* (2012) examined the species-specific data recorded by the UK (England and Wales). Although there were some erroneous or potentially erroneous records, the regional species composition was broadly comparable to that recorded by scientific observers on commercial vessels, and data quality seemed to be improving. Comparable studies to critically evaluate other national data and identify potential errors are still required, to better identify where improved training and/or market sampling may improve data quality.

18.3.3 Discards

WKSHARK3 met in Nantes in February 2017 (ICES, 2017). The objective of the meeting was to examine national discard data and to assess their suitability for use by WGEF.

It was decided that combining national data together to estimate international discards is not suitable. However, if discard data are first raised at national level, it may be possible to combine estimates. However, there are differences in raising methodologies e.g. by fleet, metier, etc., and these must be fully reported and accounted for.

For elasmobranchs, discards are not equivalent to dead catch, as there is some survival, which is probably high for some stocks and fleets. However, survival rate is not accurately known for most species.

Discard data for WGEF were included in the 2018–2021 data calls. Most countries provided raised discards. Raising methodology was considerably different, both between countries and within countries. Raised discard estimates varied by over 200% in some cases, depending on whether they were raised by vessel, fleet or landings. Therefore, discard estimates have not been calculated for skates and rays in this ecoregion.

COVID-19 affected the placing of discard observers on board commercial fishing vessels in 2020. Social distancing regulations meant that observers could not be placed on many vessels, particularly small ones. Therefore, the number of discard samples is likely down on previous years. Fishing activity may also have decreased. In Ireland, a self-sampling scheme was put in place, where discard samples were brought ashore for analysis.

See Stock Annex for historic discard discussions.

18.3.4 Discard survival

There are several ongoing studies on discard survival, e.g, SUMARIS, BIM.

Cuckoo ray has shown high post-capture condition by otter-trawls in the Celtic Sea (BIM, 2019), with 84% showing 'Excellent' condition. This may indicate high survivability post-release.

Although the existing European project INTERREG 2 Seas SUMARiS (Sustainable Management of Rays and Skates), is mainly focus on the North Sea and English Channel, results from this project may be applicable to three species with stock units straddling Division 7.d (rju.27.7de, rje.27.7de and rjn.27.678abd). SUMARIS project showed preliminary high survival rates for all species, however the final report is not yet available.

The RAYWATCH project is examining beam trawl-caught species for discard survivability in the Celtic Sea from 2020–2022.

See Stock Annex for further information on discard survivability.

18.3.5 Quality of catch data

Although so far unquantified, COVID-19 is expected to have affected fishing activity in 2020, with national or local restrictions on fishing activity reducing fishing effort for at least some of the year. Discard sampling was likely affected in most countries.

See Stock Annex.

18.4 Commercial catch composition

18.4.1 Size composition

Although length data were not examined this year, length frequencies for the more common species have been shown in earlier studies (ICES, 2007, 2011; Johnston and Clarke, 2011 WD; Silva *et al.*, 2012).

The use of length-based indicators to calculate proxy reference point is further discussed in Section 26.

18.4.2 Quality of data

See Stock Annex.

18.5 Commercial catch and effort data

A case study using French on-board observer data is provided in the stock annex discussing several stocks. The trend for *L. fullonica* is used as supporting information in the advice in 2020, therefore it is retained here. For all others, refer to the stock annex.

Shagreen ray: *Leucoraja fullonica*

rjf.27.67 (Figure 18.2): The species was caught in a relatively high proportion of OTT_DEF. The indicator suggested stability.

18.6 Fishery-independent surveys

Groundfish surveys provide valuable information on the spatial and temporal patterns in the species composition, size composition, sex ratio and relative abundance of various demersal elasmobranchs. Several fishery-independent surveys operate in the Celtic Seas ecoregion. It is noted that these surveys were not designed primarily to inform on the populations of demersal elasmobranchs, and so the gears used, timing of the surveys and distribution of sampling stations may not be optimal for informing on some species and/or life-history stages. However, these surveys provide the longest time-series of species-specific information for skates for many parts of the ecoregion. The distribution of selected skate species caught in surveys coordinated by the IBTS group (see Table 18.4 in the Stock Annex), are shown in the annual IBTS reports.

Descriptions of existing, previous and short-time-series surveys are provided in the Stock Annex.

Updated survey analyses were provided for five surveys in 2020: French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4; Figure 18.3a–e, Figure 18.4d), Irish groundfish survey (IGFS-WIBTS-Q4; Table 18.4a–e; Figure 18.4a, b and d), Spanish Porcupine Groundfish Survey (SpPGFS-WIBTS-Q4; Figure 18.5a–i), the UK (England) beam trawl survey (EngW-BTS-Q3; Table 18.5,

Figure 18.4c and 18.6) and the UK (England) Q1 Southwest ecosystem beam trawl survey (Q1SWECOS previously described as Q1SWBeam[1]; Figure 18.7a–e).

The list of fishery-independent surveys undertaken in this area include (with additional details and information on the history provided in the Stock Annex):

- French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4): 1995–present in Celtic Sea (survey did not take place in 2017).
- Irish Groundfish Survey (IGFS-WIBTS-Q4): 2003–present.
- Spanish Porcupine Groundfish Survey (SpPGFS-WIBTS-Q4): 2001–present.
- UK (Northern Ireland) Groundfish Survey – October (NIGFS-WIBTS-Q4): 1992–present.
- UK (Northern Ireland) Groundfish Survey – March (NIGFS-WIBTS-Q1).
- Scottish West Coast Groundfish Survey Q4 (ScoGFS-WIBTS-Q4): 1990–present.
- Rockall survey (Rock-IBTS-Q3): 1991–present.

Three beam trawl surveys currently operate in this ecoregion (see Stock Annex), surveying the Irish Sea, Bristol Channel, western English Channel and the West of Ireland (additional details and information on the history are provided in the Stock Annex):

- UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3): 1993–present.
- UK (England) beam trawl in western English Channel (Q1SWECOS – previously named Q1SWBeam[2]): 2006–present. This survey extended from the western English Channel (Division 7.e) to the wider Celtic Sea (Divisions 7.f-j) in 2013, however data from those Divisions used as supporting information on species spatial distribution only relates to data from 2014 onwards (Silva *et al.*, 2020).
- Irish monkfish beam trawl survey – IRL-IAMS surveys: 2016 onwards. This beam trawl survey for monkfish and megrim takes place in Q1 and Q2, to the west and northwest of Ireland. Elasmobranchs are caught during this survey, and in future may provide additional indices once a suitable time series is available.

Historical surveys which have been undertaken in the area and can provide past data on elasmobranchs include (with additional details and information on the history provided in the Stock Annex):

- UK (England and Wales) Western Groundfish Survey (EngW-WIBTS-Q4): 2004–2011.
- UK (England) beam trawl in Start Bay, Division 7.e (Eng-WEC-BTS-Q4): 1989–2010.
- Irish maturity survey for commercially important demersal fish: spring 2004–2009.
- Irish deep-water (500–1800 m) trawl survey to the west of Ireland: 2006–2009
- UK Portuguese high headline trawl 1Q (PHHT-Q1): 1982–2003.

18.6.1 Temporal trends in catch rates

The statuses of skates in this ecoregion are based primarily on the evaluation of fishery-independent trawl surveys. The available survey data have been used to evaluate the status of the stocks in 2020 under the ICES approach to data-limited stocks (Section 18.9).

Analyses of length-based data showing temporal trends from the EVHOE survey were shown for several species in 2015 (ICES, 2015a).

[1] In other ICES documents also referred as 'UK-Q1-SWBeam', 'Eng-WEC-BTS-Q1' or 'BTS-UK-Q1'.

[2] See footnote above.

18.6.2 Quality of data

18.6.2.1 Species identification in surveys

There are identification problems with certain skate species that may increase uncertainty in the quality of survey data. *Raja montagui* and *R. brachyura* may be confounded occasionally, and the identification of neonatal specimens of *R. clavata*, *R. brachyura* and *R. montagui* can also be problematic. Recent data are considered more reliable.

Many recent surveys in the ecoregion have attempted to ensure that data collected for the common skate complex be differentiated. In many cases national experts have confirmed which species have been caught in recent years. However, for some past data recorded as *Dipturus batis*, it is uncertain which of the two species (*D. batis* and *D. intermedius*) was caught. It is yet unclear how to clarify for which years and surveys records as *D. batis* refer to the actual species or to the complex.

Several skate species, including some coastal species, occur sporadically in the Celtic Seas ecoregion and may have certain sites where they are locally abundant (e.g. *Raja brachyura*). These may be under-represented in existing surveys (see Stock Annex).

18.6.3 New data

A project is currently taking place in the Tralee Bay area in the South-west of Ireland. The project is to provide data on the species composition, relative abundance and distribution of Skates and Rays for an area off the Irish coast (Dingle Bay, Tralee Bay, Brandon Bay, Shannon Estuary) known to harbour a high diversity of species some of which are critically endangered. Synoptic seasonal surveys using catch and release methods combined with individual identification of fish from photographic records will provide information on movement of these species in this area. There are a number of fisheries in the locality which may impact negatively on these populations. Vessels involved in the tangle net fishery for spiny lobster in particular have a significant by-catch of elasmobranchs. The project is also obtaining data and photographic records of elasmobranch by-catch in this fishery. Some by-catch is released alive where net soak times are low. Mitigation measures such as seasonal or spatial closures or operational measures to reduce soak times to reduce the mortality of elasmobranchs in bottom trawl and net fisheries may be developed from the project. Data for these stocks should be available for the next assessments.

To improve the data collection of skates in the future and provide a solid scientific basis for future catch advice, the EMFF funded Raywatch project was initiated (2020–2022) by ILVO. Raywatch aims to improve the current data collection for skates within the context of the Belgian National Data Gathering Programme (NDGP). The project focusses on collecting biological, catch and vitality data for seven species: thornback ray (*Raja clavata*), blonde ray (*Raja brachyura*), spotted ray (*Raja montagui*), undulate ray (*Raja undulata),* small eyed ray (*Raja microocellata*), sandy ray (*Leucoraja circularis*) and cuckoo ray (*Leucoraja naevus*) in the area of the Western Waters (ICES areas 7.a, f, g, h) and English Channel (ICES areas 7.d, e). Observers join commercial beam trawlers, where total catch weights and length frequencies for the discard and landing fraction will be collected per sex. During a selection of trips, individuals will be scored for their general liveliness ("vitality"). A dead subset of the sampled skates will be taken to the laboratory, where maturity and age will be assessed. In order to improve catch advice for skates in the future, discards and landings data will be extrapolated to fleet level and historical catch data will be integrated as well. A length-based stock assessment model will be made for thornback ray based on the estimated life history parameters, stock structure and landing and discard data collected during the project.

Discard survival studies are taking place in several countries, including Ireland, UK and Netherlands. See Section 18.3.4.

18.7 Life-history information

See Stock Annex.

18.7.1 Ecologically important habitats

See Stock Annex.

18.8 Exploratory assessment models

18.8.1 Productivity-Susceptibility Analysis

See Stock Annex

18.8.2 Previous assessments

See Stock Annex

18.9 Stock assessment

ICES provided stock-specific advice in 2020 for 2021 and 2022. Most stocks belong to Category 3 of the ICES approach to data-limited stocks. Advice is generally therefore based on survey indices. Following decisions made at ADGEF, biomass is now presented instead of numbers of individuals. Therefore from 2020, results and figures may differ from previous reports.

18.9.1 Blonde ray *Raja brachyura* in Subarea 6 and Division 4.a

Raja brachyura has a patchy distribution in Subarea 6. It is not encountered in sufficient numbers in surveys to derive trends in abundance/biomass. The stock is considered to extend to the north western North Sea (Division 4.a). It may also extend along the west coast of Ireland. This Subarea 6 and Division 4.a stock is assessed in North Sea biennial advice years (2015, 2017 and 2019), and was last assessed as a Category 5 stock, using landings data only. WKSKATE (ICES, 2021) examined this stock as a case-study and determined that there was no suitable survey or combination of surveys that could be used in a Category 3 assessment.

18.9.2 Blonde ray *Raja brachyura* in Divisions 7.a and 7.f-g

Raja brachyura has a patchy distribution, and can be locally abundant in some parts of the Irish Sea and Bristol Channel, including off southeast Ireland. Mean catch rates in the Irish Sea and Bristol Channel (e.g. as observed in the UK beam trawl survey) are low and variable. While there was a decrease in abundance in 2015, the stock has been showing an overall increasing trend in the survey. However, it is important to note that this survey does not sample this species effectively, and the survey is not used to provide advice for the stock.

With no reliable survey trend for this stock, it has been assessed since 2016 as a Category 5 stock using landings data. Landings have been stable at 1000–1200 t since 2011.

18.9.3 Blonde ray *Raja brachyura* in Division 7.e

Raja brachyura has a patchy distribution in the western English Channel, and is locally abundant on certain grounds, such as sandbank habitats in and around the Channel Islands, Normano-Breton Gulf and Lyme Bay. The trawl-survey length–frequency data examined for this stock showed a peak for juvenile fish (< 25 cm L_T), with no fish recorded between 24–31 cm L_T and occasional records of larger specimens > 70 cm L_T (Silva *et al*. 2020 WD).

Mean catch rates in a previous beam trawl survey in Great West Bay (Burt *et al.*, 2013) were low, as *R. brachyura* was caught in a relatively low proportion of tows (See Stock Annex).

With no reliable survey trend for this stock, it has been assessed since 2016 as a Category 5 stock using landings data. These reached a peak in 2015 (708 t), dropped to around 500 t per year in 2016 and 2017, but are now at over 800 t per year.

18.9.4 Thornback ray *Raja clavata* in Subarea 6

Earlier analyses of the Scottish surveys in Division 6.a suggested stable/increasing catch trends (1985–2010) although updated analyses were not available.

The IGFS survey shows a generally stable level in the last few years, following one year of peak abundance in 2016 (Figure 18.4a). This index is used in a Category 3 assessment.

18.9.5 Thornback ray *Raja clavata* in Divisions 7.a and 7.f-g

The French EVHOE survey indicated fluctuating catch rates at low levels in the Celtic Sea (Figure 18.3d). Nevertheless, it should also be noted that this survey tends to sample offshore grounds, whereas *R. clavata* is a more inshore species in this area.

The UK (England and Wales) beam trawl survey in divisions 7.a and 7.f (EngW-BTS-Q3) catches reasonable numbers of *R. clavata* and they are observed regularly, although the gear used (4 m beam trawl with chain mat) may have a lower catchability for larger individuals. The survey shows a continuous increasing trend in biomass (Figure 18.6). This survey is used for the Category 3 assessment, as this survey covers the main part of the stock range.

18.9.6 Thornback ray *Raja clavata* in Division 7.e

Analyses of data from a discontinued beam trawl survey in the western English Channel (particularly in the Great West Bay area) was provided in 2012, which suggest stable catch rates. A similar pattern of catches is seen in the current UK beam trawl survey of the western English Channel (Q1SWECOS), with most *R. clavata* captured in Lyme Bay with fewer records elsewhere (Figure 18.7a). Length–frequency showed a peak in the captures of presumably 0-group fish ≤ 20 cm. Although this survey could provide some preliminary estimates of total biomass for Division 7.e, these should be viewed only as 'qualitative assessments'. It shows an increasing trend over the longer time-series, with a recent decrease following a peak in abundance during 2014–2017 and, conflicting signals over the last two years. These analyses were consistent with the survey random stratified design and did not consider the potential effects of catchability and selectivity towards the outputs. Therefore, future work is required to better evaluate and quantify the uncertainty and risks if to use this survey for future quantitative assessment and advice (Silva *et al.*, 2020 WD).

This stock is currently assessed as a Category 5 stock, using landings data. Landings increased steadily since 2009, peaking at 423 t in 2016, followed by a decrease to 372 t in 2017, with the last two years (2018–2019) at a higher level than in 2016 (437 and 490 t, respectively).

18.9.7 Small-eyed ray *Raja microocellata* in the Bristol Channel (Divisions 7.f-g)

Although occasional specimens of *R. microocellata* are caught in Division 7.a, the main concentration of this species is in Division 7.f, with larger individuals occurring slightly further offshore (Division 7.g). The youngest size class is not often taken in surveys, as 0-group fish tend to occur in very shallow water. This species may also occur in some inshore areas of southern and south-western Ireland, although data are limited for these areas.

The UK (England and Wales) beam trawl survey in the Bristol Channel (only those data from stations in 7.f–g were used) has previously indicated stable catch rates. Low catch rates (*ca.* 1 individual per hour) were seen in 2013 (Figure 18.6). This index was automated and updated in 2020 (Silva and Ellis, 2020 WD). Applying the 2 over 5 rule, the mean CPUE for small-eyed ray ≥50 cm L_T decreased from 0.69 kg h^{-1} in 2013–2017 to 0.51 kg h^{-1} in 2018–2019. This survey trend is used in the Category 3 assessment for this stock.

18.9.8 Small-eyed ray *Raja microocellata* in the English Channel (Divisions 7.d-e)

There are also localized concentrations of *R. microocellata* in the English Channel, including around the Channel Islands (Ellis *et al.*, 2011) and Baie of Dournanenez, Brittany (Rousset, 1990), with small numbers taken elsewhere.

Preliminary analyses of data from beam trawl surveys in the western English Channel (particularly in the Great West Bay area) were provided in 2012 (See Stock Annex). The low catch rates are probably related to the patchy distribution of the species in this area. Similarly, Silva *et al.* (2020 WD) identified only a few records of this species in the western English Channel beam trawl survey, with smaller size groups likely to occur in waters shallower than can be surveyed by the research vessel.

With no adequate survey trends available, this stock is assessed under Category 5, using landings data. Landings show a stable trend from 2009–2015, followed by a decrease in 2016 that remained stable for 3 years (ca. 36 t), followed by an increase to 52 t in 2019.

18.9.9 Spotted ray *Raja montagui* in Subarea 6 and Divisions 7.b and 7.j

Raja montagui is a widespread and small-bodied skate and is taken in reasonable numbers in a variety of surveys in the ecoregion. Earlier analyses of the Scottish surveys of 6.a suggested stable/increasing catch trends, although updated analyses are not available.

Catches of *Raja montagui* in the Irish Groundfish survey in Subarea 6 and divisions 7.b and 7.j are relatively stable overall, though, with a large increase in biomass in 2016. This has declined again since 2017. (Figure 18.4b). This survey trend is used in the Category 3 assessment.

18.9.10 Spotted ray *Raja montagui* in Divisions 7.a and 7.e-h

Both the IGFS and the UK beam trawl survey (Figure 18.6) in this stock region show increasing catch rates of this species. Both surveys catch *R. montagui* in reasonable numbers, with mature individuals taken offshore on coarse grounds.

The UK beam trawl survey is currently used to provide the index for the Category 3 assessment, with a stable trend in recent years (Figure 18.4c).

Data from a now-discontinued beam trawl survey in the western English Channel (particularly in the Great West Bay area) were provided in 2012 which suggested that recent catches had increased in relation to the preceding five years, although catch rates were greater at the start of the time-series. A concurrent beam trawl survey of the western English Channel (Division 7.e) and Celtic Sea (ICES divisions 7.f-j) found this species to be more common in the English inshore strata, from Lyme Bay to west of the Scilly Isles. Since survey area extension to the wider Celtic Sea, data from 2014 show that this species can also be found in the Bristol Channel, across the entrance to St George's Channel and along the Irish coast. The survey showed a peak in the length distribution for smaller individuals < 22 cm L_T (WD05 - Silva *et al.*, 2020).

18.9.11 Cuckoo ray *Leucoraja naevus* in Subareas 6 and 7 and Divisions 8.a-b and 8.d

Leucoraja naevus is a widespread and small-bodied skate that is taken in reasonable numbers in a variety of surveys in the ecoregion, especially on offshore grounds. The stock structure of this species is insufficiently known, which makes the interpretation of catch rates in the various surveys more problematic.

The French EVHOE survey showed peaks in relative abundance in 2001–2002 and 2007–2008, with the lowest catches in 2000. The relative abundance in the combined Celtic Sea/Biscay region has been increasing in recent years. However, this survey did not take place in 2017 (Figure 18.3c).

The Spanish survey on the Porcupine Bank indicated a recent slight increase in catches (both in terms of biomass and abundance), although this was from the lowest levels in the time series in 2013 (Figure 18.5b). This survey catches mostly larger fish, with specimens < 30 cm L_T sampled infrequently (Figure 18.5c).

The UK (England and Wales) beam trawl survey in Division 7.a catches small numbers of *L. naevus,* mostly on the offshore stations on coarse grounds. The time series fluctuates, although it is currently showing an increase in recent years (Figure 18.6).

The UK (England) beam trawl in western English Channel and wider Celtic Sea caught this species mostly on grounds to the west of Falmouth, occasionally on the Eddystone grounds and, infrequent in the more easterly parts of the survey area (in Division 7.e). Since 2014, this species has been found on the Celtic Seas strata, extending into the more southern and deeper waters (Silva *et al.*, 2020).The Irish Groundfish Survey mainly catches *L. naevus* in offshore areas. There are annual variations in abundance. In general, biomass trends are similar to those seen in the EVHOE survey, however in 2015, there was a conflicting signal with the EVHOE survey (Figure 18.4d).

The combined index used in this Category 3 assessment, uses the French EVHOE survey and the Irish Groundfish Survey, and indicates that the stock increases following low stock levels in 2012–2013.

18.9.12 Sandy ray *Leucoraja circularis* in the Celtic Seas and adjacent areas

Leucoraja circularis is a larger-bodied, offshore species that may be distributed outside some of the areas surveyed during internationally coordinated surveys, and the distribution of what is assumed to be a Celtic Sea stock will extend into the northern North Sea (Division 4.a) and parts of the Bay of Biscay (Subarea 8). This species is taken only infrequently in most surveys, such as the EVHOE survey (Figure 18.3a) with some nominal records considered unreliable.

Only the Spanish Porcupine Bank survey covers an important part of the habitat of *L. circularis* and catches this species in any quantity (Figure 18.5a). Peak catches were observed in 2007–2008, with a decline following, but catches steadily increased returning to the higher levels observed in this time series, until 2016–2017 when the biomass decreased. Overall, the time-series shows low and variable catch rates, with an increasing trend until 2015, followed by a decrease in recent years (Figure 18.5b). This survey catches a broad size range, with both smaller (< 20 cm L_T) and some larger (> 100 cm L_T) specimens sampled (Figure 18.5c).

Given that the only survey that samples this species effectively only covers a small proportion of the broader stock range, it is not known whether the survey index would be appropriate for the overall stock. Consequently, this stock is assessed as a Category 5 stock, using landings data. Landings of this species were at their highest level in 2009, at near 80 t, but subsequently dropped to around 50–60 t. Landings dropped to their lowest level (38 t in 2015), then increased to 77 t in 2016, before returning to ca. 60 t in 2017. ICES were not requested to provide catch advice for this stock in 2018.

The landings estimated by WGEF are lower than national estimates, as WGEF consider nominal landings of 'sandy ray' from outside their main range to refer to *R. microocellata.*

18.9.13 Shagreen ray *L. fullonica* in the Celtic Seas and adjacent areas

Leucoraja fullonica is a larger-bodied, offshore species that may be distributed outside some of the areas surveyed during internationally coordinated surveys, and the distribution of what is assumed to be a Celtic Sea stock will extend into the northern North Sea (Division 4.a) and parts of the Bay of Biscay (Subarea 8).

This species is taken in small numbers in the EVHOE survey (Figure 18.3b), with catch rates declining. There is a lack of survey for most other parts of the stock area, although the increase in beam trawl surveys in the Celtic Sea may provide more data in the future.

The lack of appropriate survey coverage across the stock range and low, variable catch rates of this species means that a Category 5 assessment using landings data is currently used. Landings in 2016 were at their lowest level (186 t) since 2009, with the peak (301 t) seen in 2010 subsequently declining.

18.9.14 Common skate *Dipturus batis*-complex (flapper skate *Dipturus intermedius* and blue skate *Dipturus batis*) in Subarea 6 and divisions 7.a–c and 7.e–j

Although common skate *D. batis* has long been considered depleted, on the basis of its loss from former habitat and historical decline (Brander, 1981; Rogers and Ellis, 2000), this species has recently been confirmed to comprise two species, and longer term data to determine the extents to which the two individual species have declined are lacking. Although the nomenclature is still

to be ratified, the smaller species (the form described as *D. flossada* by Iglésias *et al.*, 2010) will probably remain as *Dipturus batis* and the larger species may revert to *D. intermedius.*

Blue skate *Dipturus batis* occurs in parts of Division 6.b (Rockall Bank) and is the predominant member of the complex in the Celtic Sea (divisions 7.e–k) and it likely extends into Subarea 8. The northern limits to its distribution are unclear.

Flapper skate *D. intermedius* occurs primarily in Division 6.a, parts of Division 6.b, and the northern North Sea (Division 4.a). Smaller numbers are taken in the Celtic Sea (divisions 7.e–k), although its southerly and northerly limits are unknown.

Both species may occur in the intervening areas of divisions 7.a–c, but it is less clear as to which species predominates. The bathymetric ranges of both species are poorly known, as is their western distribution ranges, although unspecified *D. batis* have been reported from the Mid-Atlantic Ridge.

Given that much of the data refer to the species-complex, both species are currently treated together until a suitable time-series of species-specific data are available.

The documented loss of the common skate complex from parts of their former range (e.g. Division 7.a) suggested the complex to be depleted in the Celtic Sea ecoregion.

Analyses of recent data from the Spanish Porcupine Bank Survey indicate low but increasing catch rates for *Dipturus* spp., with the biomass and numbers encountered at their highest level (*ca.* 0.5 individuals and 5 kg per haul) across the time series (Figure 18.5f). The bulk of this catch is comprised of *D. nidarosiensis*, followed by *D. batis* and very few specimens of *D.* intermedius encountered (which only entered the survey time series in 2013 for the first time).

A previous examination of Scottish groundfish survey data (see ICES, 2010b; 2011) indicated some increase in the proportion of hauls in which *D. batis*-complex were observed (Figure 18.7g), although it should be recognized that catch rates were low and with wide confidence intervals. Updated analyses are required.

Given the lack of robust survey data over the stock range, and lack of landings data (due to their prohibited status), a Category 6 assessment was applied to this stock, and trends in stock size or indicator cannot be evaluated.

Recent prohibitions on landings of *D. batis* complex, and *D. nidarosiensis*, have resulted in increases in declared landings of *D. oxyrinchus*. Landings figures and advice refer to *Dipturus* spp., as landings of these species are believed to be confounded.

Particularly high levels of *D. oxyrinchus* were reported in 2019. It is not known whether these reflect an increase in catches of this species, or whether they are confounded with catches of other *Dipturus* species. A revision of the landings table in the 2020 Working Group noted discard information from Spain in the period 2015–2017 were erroneously included in the landings. In addition, Danish landings data for 2017 and 2018 were updated. As such a noticeable change in the landings presented in the current advice and report (Table 18.1 and 18.2) occurred.

18.9.15 Undulate ray *Raja undulata* in divisions 7.b and 7.j

This isolated stock has a very local distribution, mainly in Tralee Bay on the Southwest Irish coast.

There are no trawl surveys that can be used to assess this stock. However, data supplied by Inland Fisheries Ireland (Wögerbauer *et al.*, 2014 WD*)* shows that tag and recapture rates for *R. undulata* in Tralee Bay (Division 7.j) have significantly declined since the 1970s. Although these

data do not allow for potential changes in tagging effort, it suggests that this stock is overexploited (Figure 18.8).

Given the lack of survey data over the coastal habitat for this stock, and a lack of landings data (due to management measures), a Category 6 assessment was applied to this stock, and trends in stock size or indicator cannot be evaluated.

18.9.16 Undulate ray *Raja undulata* in Divisions 7.d-e (English Channel)

There is thought to be a discrete stock of *R. undulata* in the English Channel (divisions 7.d–e), with the main part of the range extending from the Isle of Wight to the Normano-Breton Gulf. This stock is surveyed, in part, by two different beam trawl surveys: the Channel beam trawl survey (see Chapter 15) and the western English Channel (Q1SWECOS, WD05 - Silva *et al.*, 2020), as well as the French Channel Groundfish survey CGFS-Q4 (see Chapter 15). The CGFS-Q4 survey provides a biomass index for undulate ray in Division 7.d, considered representative for the whole stock. The distribution and length ranges of *R. undulata* caught in the western English Channel survey are provided in the Stock Annex. Catch rates are generally variable, partly due to the patchy distribution of this species.

Since 2018, the advice has been based on catches while it was previously based on landings (see stock annex). This stock is managed under a specific TAC. This precautionary TAC has been increasing since 2016 following the biomass index but is considered quite constraining, resulting in high discard rates (0.93 on average in 2018–2019).

Since ICES (2013) commented "*If ICES are to be able to provide more robust advice on the status of this stock, then either dedicated surveys or more intensive sampling of their main habitat in existing surveys should be considered*" there has been a lot of dedicated surveys by French organisations under the Raimouest and RECOAM projects.

LeBlanc *et al.* (2014 WD) summarized the project so far, and showed that *R. undulata* was the main skate species caught in the Norman-Breton Gulf and dominated in coastal waters. Although it occurs throughout much of the English Channel, its distribution appears to be concentrated in the central region. Tagging studies indicate high site fidelity (Stéphan *et al.*, 2014 WD; see Stock Annex). In the Normano-Breton Gulf, 1 488 *R. undulata* were tagged (656 females (29–103 cm L_T) and 832 males (28–99 cm L_T), with a 5% (n = 77) recapture rate. All the skates tagged in a region were recaptured in the same region, and distance travelled was short (< 80 km). Given that the prohibited listing of the species may have deterred reporting of tags in some fisheries, the degree of exchange between the Normano-Breton Gulf and the south coast of England remains unclear. In Division 7.e, 58.4% of the recaptured skates were taken less than 5 km from their release location, and 75.3% were recaptured less than 20 km from the release location. The survey with the best coverage of this stock area is the French Channel Groundfish Survey (CGFS-Q4), where the biomass indicator used in the Category 3 assessment shows the stock to be at the highest level of the time series in 2019, with an index value more than twice as high as the value for 2018.

French *Raja undulata* self-sampling program

In 2016, Council Regulation (EU) 2016/458 of 30 March 2016 amended Regulations (EU) 2015/523 as regards individual TACs for *R. undulata* in ICES divisions.

Under this regulation, only vessels possessing a compulsory fishery license were allowed to catch *R. undulata*. Simultaneously, licensed vessels are obliged to record information on species captured by fishing haul and report to national agencies (Direction des Pêches Maritimes et de l'Aquaculture (DPMA) of the French Ministry for Agriculture and Fisheries). The conditioning of landings of the species upon the possession of a special fishing licence lifted in 2019. This

coincides with the end of the self-sampling programme. However, French fishers have been encouraged to report their discards of undulate ray in logbooks since then.

First results from this self-sampling programme are described in more detail in the Working Document (Gadenne, 2017 WD).

Whilst the catch rates in the UK-7d-BTS are too low to provide quantitative advice, this time series shows similar trends to the French CGFS, including the recent increase in catch rates.

In 2018, France made a special request to ICES to re-evaluate the advice for this stock. In particular, further industry-provided data were made available. This special request is further discussed in Annex 8 of this report. WGEF recommends that a benchmark process be undertaken to develop a protocol for incorporating discard data, particularly from industry programmes, into the elasmobranch stock assessments. Since 2018, the advice has been formulated in terms of catch, while it was previously based on landings. For this transition year, and without a precise enough estimate of the survival rate of discarded undulate ray, it was assumed that "all discards survive". Biseau (WD07, 2020) explored the influence of the consideration of a more realistic survival rate of discards based on a minimal estimate derived from a study carried out in the Bay of Bourgneuf (Morfin *et al*., 2019) during which discarded undulate rays were equipped with acoustic tags. In this analysis, different assumptions on the future discard rate were also made. The main conclusion of this analysis was that accounting for the available information on the survival rate of discards for this species whilst maintaining the level of removals would lead to an increase in the recommended landings. However, this would imply a reduction in the corresponding catch.

WKSHARK5, a workshop which proposed a method to provide fishing opportunities that ensure that exploitation is sustainable when a species has been under moratorium, as is the case with the undulate ray, took place in February 2019. See that report for further details on this stock (ICES, 2020).

An explanatory assessment using length-based indicators was performed for years 2016–2017 and 2018–2019 based on data collected by the onboard observation programme (DCF programme) on French fishing vessels in divisions 7.d-e (WD06 – Baulier, 2020). The assessment used the eight indicator ratios recommended by WKLIFE (ICES, 2015b) and combined catch data from bottom trawls and trammel nets raised to the corresponding fleets. The reference indicator ratio $L_{mean}/L_{F=M}$ (mean length of individuals larger than the length at first capture over the theoretical average length resulting from exploitation with a fishing mortality equal to natural mortality, which is a proxy for F_{MSY}) suggested that the stock was exploited with a fishing mortality lower than F_{MSY}. However, due to deviations from assumptions necessary to the derivation of reference points (especially steady state and knife-edge selectivity), the actual difference between current fishing mortality and F_{MSY} could not be established. Nevertheless, this diagnosis appeared to be robust to the values survival rate of discards applied, the degree of smoothing of the length distribution and the time period considered (2016–2017 or 2018–2019). In addition, the diagnosis for undulate ray turned out to be at least as satisfactory as the ones for thornback and blonde rays in the same ICES divisions.

18.9.17 Other skates in subareas 6 and 7 (excluding Division 7.d)

This section relates to skates not specified elsewhere in the ICES advice. This includes skates not reported to species level and some other, mainly deep-water species throughout the region. It also applies to *R. clavata, R. brachyura,* and *R. microcellata* outside the current defined stock boundaries (Table 18.3).

No specific assessment can be applied to this species group, and nominal landings have been shown to have declined dramatically, primarily as a result of improved species-specific reporting of the main commercial skate stocks.

18.10 Quality of assessments

Commercial data are insufficient to proceed using a full stock assessment, although data are improving.

Several updated analyses of temporal changes in relative abundance in fishery-independent surveys were carried out in 2018. These surveys provide the most comprehensive time-series of species-specific information, and cover large parts of the ecoregion. Hence, fishery-independent trawl data are considered the most appropriate data for evaluating the general status of the more common species.

However, it must be stressed that not all skates and rays are well sampled by these surveys, and even some of the most common species (*R. montagui* and *R. clavata*) may only occur in about 30% of hauls. There is also uncertainty regarding the mean catch rates, due to the large confidence intervals.

There are several other issues that influence the evaluation of stock status:

1. The stock identity for many species is not accurately known (although there have been some tagging studies and genetic studies to inform on some species, and the stocks of species with patchy distributions can be inferred from the spatial distributions observed from surveys). For inshore, oviparous species, assessments by ICES division or adjacent divisions may be appropriate, although for species occurring offshore, including *L. naevus*, a better delineation of stock boundaries is required;
2. Age and growth studies have only been undertaken for the more common skate species, although IBTS and beam trawl surveys continue to collect maturity information. Other aspects of their biology, including reproductive output, egg-case hatching success, and natural mortality (including predation on egg-cases) are poorly known;
3. The identification of skate species is considered to be reliable for recent surveys, although there are suspected to be occasional misidentifications;
4. Although fishery-independent surveys are informative for commonly occurring species on the inner continental shelf, these surveys are not well suited for species with localized, coastal distributions (e.g. *R. undulata*, angel shark), patchy distributions (e.g. *R. brachyura*) or outer shelf distributions (e.g. *L. fullonica*).

18.11 Reference points

No reference points have been adopted. Potential methods for establishing precautionary reference points from using the catch-curve method are described in the Stock Annex.

The use of length-based indicators (LBIs) to calculate proxy reference points was discussed, and is further elaborated in Section 26. LBIs for several stocks were estimated by Walker *et al.*, 2018WD and Miethe and Dobby, 2018WD.

18.12 Conservation considerations

In 2015, the IUCN published a European Red List of Marine Fisheries (Nieto *et al.*, 2015). It should be noted the listings below are on a Europe-wide scale for each species, and these listings are not stock-based.

Species	IUCN Red List Category
Amblyraja radiata	Least concern
Dipturus batis	Critically Endangered
Dipturus nidarosiensis	Near Threatened
Dipturus oxyrinchus	Near Threatened
Leucoraja circularis	Endangered
Leucoraja fullonica	Vulnerable
Leucoraja naevus	Least concern
Raja brachyura	Near Threatened
Raja clavata	Near Threatened
Raja microocellata	Near Threatened
Raja montagui	Least concern
Raja undulata	Near Threatened
Rajella fyllae	Least concern
Rostroraja alba	Critically Endangered

In 2016, a red-list for Irish cartilaginous fish (Clarke *et al.,* 2016) was published. This assessed and rated the following species in Irish waters:

Species	Irish red-list category
Dipturus flossada (~batis)	Critically endangered
Dipturus intermedia (~batis)	Critically endangered
Dipturus nidarosiensis	Near Threatened
Dipturus oxyrinchus	Vulnerable
Leucoraja circularis	Near Threatened
Leucoraja fullonica	Vulnerable
Leucoraja naevus	Vulnerable
Raja brachyura	Near Threatened
Raja clavata	Least concern
Raja microocellata	Least concern
Raja montagui	Least concern
Raja undulata	Endangered
Rajella fyllae	Least concern
Rostroaja alba	Critically endangered

18.13 Management considerations

A TAC was only introduced in 2009 for the main skate species in this region. Reported landings may be slightly lower than the TAC, but this can be influenced by various issues (e.g. quota allocation and poor weather). There was evidence that quota was restrictive for some nations from at least 2014.

Raja undulata and *R. microocellata* are currently subjected to limited fishing opportunities, which may disproportionally impact upon some coastal fisheries.

Currently, fishery-independent trawl survey data provide the best time-series of species-specific information. Technical interactions for fisheries in this ecoregion are shown in the Stock Annex.

Main commercial species

Thornback ray, *Raja clavata,* is one of the most important commercial species in the inshore fishing grounds of the Celtic Seas (e.g. eastern Irish Sea, Bristol Channel). It is thought to have been more abundant in the past, and more accurate longer-term assessments of the status of this species are required.

Blonde ray, *Raja brachyura,* is a commercially valuable species. The patchy distribution of *R. brachyura* means that existing surveys have low and variable catch rates. More detailed investigations of this commercially valuable species are required.

Cuckoo ray, *Leucoraja naevus,* is an important commercial species on offshore grounds in the Celtic Sea. Further studies to better define the stock structure are required to better interpret these contrasting abundance trends.

The main stock of small-eyed ray, *Raja microocellata,* occurs in the Bristol Channel, and is locally important for coastal fisheries. Similarly, the English Channel stock of undulate ray *Raja undulata* is also important for inshore fleets.

Spotted ray, *Raja montagui,* is also commercially important, although a higher proportion of the catch of this small-bodied species is discarded in some fisheries. Commercial data for *R. brachyura* and *R. montagui* are often confounded.

Other species

Historically, species such as *L. circularis* and *L. fullonica* may have been more widely distributed on the outer continental shelf seas. These species are now encountered only infrequently in some surveys on the continental shelf, though they are still present in deeper waters along the edge of the continental shelf, and on offshore banks. Hence, studies to better examine the current status of these species in subareas 6–7 should be undertaken.

The larger-bodied species in this area are from the genus *Dipturus*, and data are limited for all species. *Dipturus batis*-complex were known to be more widespread in inner shelf seas historically, and whilst locally abundant in certain areas, have undergone a decline in geographical extent.

18.14 References

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Table 18.1. Skates and rays in the Celtic Seas. Regional total landings (ICES estimates, tonnes) of Celtic Seas skate stocks by nation. Some of these stocks extend outside the Celtic Seas ecoregion and data for these divisions are reported in relevant report chapters.

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BEL	raj.27.67a-ce-k	1568	1328	1405	413	416	333	227	74	8	1	1	3	3	0	8	7
	rjb.27.67a-ce-k				0	0	0			0	0				0	0	0
	rjc.27.7afg			0	328	216	197	302	441	391	240	350	241	212	197	339	314
	rjc.27.7e				5	2	8	3	4	4	3	9	14	21	14	13	9
	rje.27.7de						3	5	5	7	7	9	9	12	15	16	15
	rje.27.7fg						37	117	124	99	83	106	123	116	121	137	94
	rjf.27.67														0.01		
	rjh.27.4a6					0	0										
	rjh.27.7afg				166	170	210	313	404	406	351	359	313	338	348	520	721
	rjh.27.7e				7	6	3	5	5	6	3	6	11	9	14	10	23
	rji.27.67							0	0	0	0	0	0	2	2	1	1
	rjm.27.67bj						0										
	rjm.27.7ae-h				78	63	55	120	70	3	0	1	7	2	15	15	44
	rjn.27.678abd			0	86	81	70	112	93	97	48	51	27	26	28	25	18
	rju.27.7de												5	24	15	0	0
BEL Total		1568	1328	1405	1083	953	917	1204	1219	1022	737	893	753	763	768	1084	1246
DE	raj.27.67a-ce-k	39	7	26	60	2	4	3	1						0.5	0	0
	rjf.27.67															13	0
DE Total		39	7	26	60	2	4	3	1						0.5	13	0
DK	rjh.27.4a6											0				0	0
DK Total												0				0	0
ES	raj.27.67a-ce-k	2231	2568	2340	1946	206	52	23	15	9	12	45	61	62	357	135	17
	rjb.27.67a-ce-k	24	6	11	28	5	0.2	1	5	23	80	214	232	256	0	0	0
	rjc.27.6					16	2	10	6	23	21	12	12	48	43	69	60

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	rjc.27.7afg											5	6	9	0.1	0.0	0.1
	rjc.27.7e						0	0									
	rjf.27.67					62	42	29	20	33	20	34	15	22	20	15	14
	rjh.27.4a6					0											
	rji.27.67	86	74	40	7	30	16	22	8	10	5	3	5	11	9	5	2
	rjm.27.67bj				7	7	10	5	0	0	0	1				0.3	
	rjm.27.7ae-h						0				0	0					
	rjn.27.678abd				1	778	480	387	311	373	300	343	372	305	335	295	192
ES Total		2341	2648	2392	1986	1103	603	477	365	471	438	635	701	712	763	520	285
FRA	raj.27.67a-ce-k	2048	1740	1757	1669	548	314	174	160	139	128	123	130	193	126	29	33
	rjb.27.67a-ce-k	351	295	308	414	68	30	15	23	21	32	33	17	19	25	0	0
	rjc.27.6	64	78	73	82	39	24	19	39	28	10	2	1	1	3	13	17
	rjc.27.7afg	379	264	238	181	147	131	133	106	95	107	70	121	147	101	117	80
	rjc.27.7e	95	86	82	64	122	101	114	108	181	224	225	213	176	212	263	264
	rje.27.7de	21	19	19	22	32	28	28	24	26	24	24	8	8	11	17	14
	rje.27.7fg	27	23	18	21	29	21	16	30	30	65	31	5	56	69	92	69
	rjf.27.67	32	25	33	28	144	150	152	147	127	131	151	130	125	129	125	133
	rjh.27.4a6					1					1	1	1	0	1	1	1
	rjh.27.7afg					36	73	131	87	52	170	218	275	257	172	295	277
	rjh.27.7e					56	148	205	169	191	281	304	223	242	396	450	539
	rji.27.67	199	152	185	178	46	35	25	35	26	33	34	37	34	35	25	24
	rjm.27.67bj	13	7	3	4	2	4	7	5	17	53	43	47	40	23	8	1
	rjm.27.7ae-h	1080	902	833	870	785	934	1062	1135	899	912	745	819	661	834	814	576
	rjn.27.678abd	3164	2565	2575	2507	3217	3069	2909	2571	2195	2515	2621	2233	2144	2288	2398	1984
	rju.27.7bj					0				0		0	1	1	0	0	0.3
	rju.27.7de					19	9	20	6	3	10	50	58	79	86	181	159

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
FRA Total		7473	6157	6123	6041	5291	5071	5010	4646	4031	4695	4674	4319	4182	4511	4828	4170
GBR	raj.27.67a-ce-k	2773	2454	2398	1478	508	290	168	153	101	77	46	34	34	30	45	56
	rjb.27.67a-ce-k				96	22	1	19	12	1	63	118	116	112	211	146	5
	rjc.27.6				1	56	61	57	67	120	120	114	147	114	201	233	167
	rjc.27.7afg			0	204	300	371	384	483	416	252	309	274	277	324	322	322
	rjc.27.7e	0	0		3	82	98	98	129	151	151	158	195	173	206	212	189
	rje.27.7de				4	18	40	28	33	32	36	39	19	15	12	20	24
	rje.27.7fg			0	91	157	214	189	208	117	79	78	69	30	55	83	67
	rjf.27.67				13	44	108	97	79	85	55	25	39	21	14	18	17
	rjh.27.4a6				7	5	7	17	4	0	1	3	2	1	3	1	0.3
	rjh.27.7afg		0	0	97	138	226	273	261	262	229	245	245	272	328	404	322
	rjh.27.7e		0		32	159	215	204	175	222	295	396	352	251	323	435	451
	rji.27.67				0	2	0	0	3	25	22	1	35	23	31	4	9
	rjm.27.67bj				5	16	27	32	30	27	29	43	49	43	62	58	1
	rjm.27.7ae-h	0		0	12	38	102	88	85	90	80	70	80	89	93	118	82
	rjn.27.678abd				225	321	421	402	306	269	262	266	254	260	272	289	186
	rju.27.7de				2	2			0			5	22	36	43	63	66
GBR Total		2773	2454	2399	2270	1868	2179	2056	2031	1919	1752	1917	1933	1752	2208	2452	1965
IRL	raj.27.67a-ce-k	2117	1728	1581	1283	1007	547	394	410	243	219	227	230	284	188	148	87
	rjb.27.67a-ce-k			0		2	4	17	1	0	0	9	7	9	9	7	0
	rjc.27.6					3	33	56	69	71	85	87	99	130	90	101	70
	rjc.27.7afg					8	80	126	134	146	191	169	220	232	219	182	192
	rjc.27.7e									0		2		2	4	2	1
	rje.27.7de													2	0	0	0
	rje.27.7fg						0	0	0	0	0	0	0	0	0	0	0
	rjf.27.67						1	6	7	6	4	2	2	49	63	38	23

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	rjh.27.4a6					0	4	1	1	24	9	9	11	5	23	33	20
	rjh.27.7afg	3	6			5	402	382	407	377	420	351	171	154	228	396	383
	rjh.27.7e								0			2		2	3	0.4	0.7
	rji.27.67						0	4	0							0.2	0
	rjm.27.67bj					1	20	18	25	24	43	28	20	12	19	12	3
	rjm.27.7ae-h					0	19	63	53	40	49	48	41	10	58	64	41
	rjn.27.678abd					12	55	106	108	93	83	79	69	69	115	103	73
	rju.27.7bj														3	0	0
IRL Total		2120	1734	1581	1283	1038	1165	1173	1218	1025	1104	1012	871	961	1022	1088	895
NLD	raj.27.67a-ce-k	0	1	0	0	0	0	0	0	0							
	rjc.27.7afg												0				1
	rjc.27.7e					0	2	1	0	2		0	0	0	0	1	1
	rjh.27.7e								0	0				0		0	0
	rjm.27.7ae-h					0		0		0			0			0	0.1
	rjn.27.678abd						0			0	0			0			0
NLD Total		0	1	0	0	1	2	1	1	2	0	0	0	0	0	1	2
NOR	raj.27.67a-ce-k	50	101	89	77	96	131	62	107	99	157	272	312	153	30	274	331
NOR Total		50	101	89	77	96	131	62	107	99	157	272	312	153	30	274	331
Grand Total		16364	14429	14016	12800	10355	10071	9986	9587	8568	8883	9740	9208	8524	9311	10259	8892

Table 18.2. Skates and rays in the Celtic Seas. Regional total landings (ICES estimates, tonnes) of Celtic Seas skate stocks by stock. Some of these stocks extend outside the Celtic Seas ecoregion and data for these divisions are reported in relevant report chapters.

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
raj.27.67a-ce-k	BEL	1568	1328	1405	413	416	333	227	74	8	1	1	3	3	0	8	7
	DE	39	7	26	60	2	4	3	1						1		
	ES	2231	2568	2340	1946	206	52	23	15	9	12	45	61	62	357	135	17
	FRA	2048	1740	1757	1669	548	314	174	160	139	128	123	130	193	126	29	33
	GBR	2773	2454	2398	1478	508	290	168	153	101	77	46	34	34	30	45	56
	IRL	2117	1728	1581	1283	1007	547	394	410	243	219	227	230	284	188	148	87
	NLD	0	1	0	0	0	0	0	0	0							
	NOR	50	101	89	77	96	131	62	107	99	157	272	312	153	30	274	331
raj.27.67a-ce-k Total		10826	9926	9597	6928	2783	1671	1052	919	600	594	714	770	729	731	639	531
rjb.27.67a-ce-k	BEL				0	0	0			0	0				0	0	0
	ES	24	6	11	28	5	0.21	1	5	23	80	214	232	256	0	0	0
	FRA	351	295	308	414	68	30	15	23	21	32	33	17	19	25	0	0
	GBR				96	22	1	19	12	1	63	118	116	112	211	146	5
	IRL			0		2	4	17	1	0	0	9	7	9	9	7	0
rjb.27.67a-ce-k Total		375	301	319	538	97	35	52	42	45	175	375	373	396	245	153	5
rjc.27.6	ES					16	2	10	6	23	21	12	12	48	43	69	60
	FRA	64	78	73	82	39	24	19	39	28	10	2	1	1	3	13	17
	GBR				1	56	61	57	67	120	120	114	147	113	201	233	167
	IRL					3	33	56	69	71	85	87	99	130	90	101	70
rjc.27.6 Total		64	78	73	82	114	120	141	181	241	236	213	260	293	337	416	315
rjc.27.7afg	BEL			0	328	216	197	302	441	391	240	350	241	212	197	339	314
	ES											5	6	9	0	0.1	0.1
	FRA	379	264	238	181	147	131	133	106	95	107	70	121	147	101	117	80
	GBR			0	204	300	371	384	483	416	252	309	274	277	324	322	322

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	IRL					8	80	126	134	146	191	169	220	232	219	182	192
	NLD												0				0
rjc.27.7afg Total		379	264	238	713	671	780	944	1165	1048	790	903	861	878	840	960	909
rjc.27.7e	BEL				5	2	8	3	4	4	3	9	14	21	14	13	9
	ES						0	0									
	FRA	95	86	82	64	122	101	114	108	181	224	225	213	176	212	263	264
	GBR	0	0		3	82	98	98	129	151	151	158	195	173	206	212	189
	IRL									0		2		2	4	2	1
	NLD					0	2	1	0	2		0	0	0		1	1
rjc.27.7e Total		95	86	82	71	206	208	216	242	339	379	395	423	372	437	490	464
rje.27.7de	BEL						3	5	5	7	7	9	9	12	15	16	15
	FRA	21	19	19	22	32	28	28	24	26	24	24	8	8	11	17	14
	GBR				4	18	40	28	33	32	36	39	19	15	12	20	24
	IRL													2			
rje.27.7de Total		21	19	19	26	50	70	61	62	65	67	72	36	36	38	52	53
rje.27.7fg	BEL						37	117	124	99	83	106	123	116	121	137	94
	FRA	27	23	18	21	29	21	16	30	30	65	31	5	56	69	92	69
	GBR			0	91	157	214	189	208	117	79	78	69	30	55	83	67
	IRL						0	0	0	0	0	0	0	0	0	0.1	0
rje.27.7fg Total		27	23	18	112	187	272	323	362	247	227	216	198	201	245	312	230
rjf.27.67	DE															13	0
	BEL														0	0	0
	ES					62	42	29	20	33	20	34	15	22	20	15	14
	FRA	32	25	33	28	144	150	152	147	127	131	151	130	125	129	125	133
	GBR				13	44	108	97	79	85	55	25	39	21	14	18	17
	IRL						1	6	7	6	4	2	2	49	63	38	23

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
rjf.27.67 Total		32	25	33	41	250	301	283	253	251	211	212	186	217	225	208	186
rjh.27.4a6	BEL					0	0										0.1
	DK											0					
	ES					0											
	FRA					1					1	1	1	0	1	1	1
	GBR				7	5	7	17	4	0	1	3	2	1	3	1	0.3
	IRL					0	4	1	1	24	9	9	11	5	23	34	20
rjh.27.4a6 Total					7	6	10	17	5	24	10	14	14	6	27	35	21
rjh.27.7afg	BEL				166	170	210	313	404	406	351	359	313	338	348	520	721
	FRA					36	73	131	87	52	170	218	275	257	172	295	277
	GBR		0	0	97	138	226	273	261	262	229	245	245	272	328	404	322
	IRL	3	6			5	402	382	407	377	420	351	171	154	228	396	383
rjh.27.7afg Total		3	6	0	263	350	910	1099	1160	1097	1170	1172	1004	1020	1077	1616	1703
rjh.27.7e	BEL				7	6	3	5	5	6	3	6	11	9	14	10	23
	FRA					56	148	205	169	191	281	304	223	240	396	450	538
	GBR		0		32	159	215	204	175	222	295	396	352	251	323	435	451
	IRL								0			2		2	3	1	1
	NLD								0	0				0		1	1
rjh.27.7e Total			0		39	221	365	414	349	419	579	708	587	504	735	896	1014
rji.27.67	BEL							0	0	0	0	0	0	2	2	1	1
	ES	86	74	40	7	30	16	22	8	10	5	3	5	11	9	5	2
	FRA	199	152	185	178	46	35	25	35	26	33	34	37	34	25	25	24
	GBR				0	2	0	0	3	25	22	1	35	23	31	4	9
	IRL						0	4	0							0	0
rji.27.67 Total		285	226	226	185	78	51	51	46	61	61	38	77	69	77	36	36
rjm.27.67bj	BEL						0										

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	ES				7	7	10	5	0	0	0	1	0	0	0	0.3	0
	FRA	13	7	3	4	2	4	7	5	17	53	43	47	40	23	8	1
	GBR				5	16	27	32	30	27	29	43	49	44	62	58	1
	IRL					1	20	18	25	24	43	28	20	12	19	12	3
rjm.27.67bj Total		13	7	3	16	27	62	63	61	68	125	114	116	96	104	79	5
rjm.27.7ae-h	BEL				78	63	55	120	70	3	0	1	7	2	16	15	44
	ES						0				0	0					
	FRA	1080	902	833	870	785	934	1062	1135	899	912	745	819	661	834	814	576
	GBR	0		0	12	38	102	88	85	90	80	70	80	89	93	118	82
	IRL					0	19	63	53	40	49	48	41	10	58	65	41
	NLD					0		0		0			0			0.2	0.1
rjm.27.7ae-h Total		1080	902	833	960	887	1110	1332	1344	1032	1042	864	947	762	1001	1012	741
rjn.27.678abd	BEL			0	86	81	70	112	93	97	48	51	26	26	28	25	18
	ES				1	778	480	387	311	373	300	343	372	305	335	295	192
	FRA	3164	2565	2575	2507	3217	3069	2909	2571	2195	2515	2621	2233	2144	2288	2398	1984
	GBR				225	321	421	402	306	269	262	266	254	259	272	289	186
	IRL					12	55	106	108	93	83	79	69	69	115	103	73
	NLD						0			0	0	0	0	0	0	0	0
rjn.27.678abd Total		3164	2565	2575	2819	4408	4096	3916	3388	3028	3209	3360	2955	2804	3038	3111	2453
rju.27.7bj	IRL														3	0	0
	FRA					0				0		0	1	1	0	0.3	0.3
rju.27.7bj Total						0				0		0	1	1	3	0	0

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
rju.27.7de	BEL												5	24	15	0.2	0.1
	FRA					19	9	20	6	3	10	50	58	79	86	181	159
	GBR				2	2			0			5	22	36	43	63	66
rju.27.7de Total					2	21	9	20	6	3	10	55	84	139	143	244	225
Grand Total		16364	14429	14016	12800	10355	10071	9986	9587	8568	8883	9740	9208	8524	9311	10259	8892

Table 18.3. Skates and rays in the Celtic Seas. ICES Estimates of landings for other skates and rays in subareas 6–7 (excluding Division 7.d) by species, country, and year (in tonnes). Data revised in 2021.

Country	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BEL	*Raja brachyura*	0.01	0.01	0.00	0.04	0.00	0.39	0.47	1	2			
	Raja clavata	0.01	0.02	0.00	0.03		0.02	1	0.03	0.08			
	Raja undulata								1	0.23			
	Rajiformes (indet)	416	333	227	74	8	0.46	0.03	1	0.30	0.18	8	7
BEL Total		**416**	**333**	**227**	**74**	**8**	**1**	**1**	**3**	**3**	**0.18**	**8**	**7**
DEU	Rajiformes (indet)	2	4	3	1						1		
DEU Total		**2**	**4**	**3**	**1**						**1**		
ESP	*Raja brachyura*	1			0.21	1							
	Raja clavata	65	23	13	6	5	10	44	59	62	18	14	16
	Raja montagui		3										
	Rajiformes (indet)	139	26	11	9	4	2	1	1		338	121	1
ESP Total		**206**	**52**	**23**	**15**	**9**	**12**	**45**	**61**	**62**	**357**	**135**	**17**
FRA	*Amblyraja hyperborea*				3	0.48	2	18	10	7			
	Amblyraja radiata					4	8	5	9	9			
	Raja brachyura	2	5	6	27	31	25	29	45	62			
	Raja clavata	82	92	45	53	61	46	42	36	27			
	Raja microocellata	0.23	2	0.13	0.15	1	1	2	0.16	1			
	Raja montagui	0.01	0.01	0.11		0.00	0.04	0.02	0.04	58			
	Raja undulata		0.03		0.00			0.04	0.06				
	Rajidae									0.00	4	0.00	
	Rajiformes (indet)	463	215	123	77	42	46	28	31	30	122	29	33
FRA Total		**548**	**314**	**174**	**160**	**139**	**128**	**123**	**130**	**193**	**126**	**29**	**33**
GBR	*Amblyraja hyperborea*					0.11	0.11						1
	Amblyraja radiata			0.05	0.03	1		0.23			0.49		
	Raja brachyura	10	5	4	11	1	1	3	2	2	3	2	1
	Raja clavata	30	55	58	58	35	14	20	27	24	12	18	21
	Raja microocellata	6	8	4	2	11	16	18	1	0.25	1	2	0.3
	Raja montagui											0.03	
	Raja undulata								0.17	0.01	0.19	0.36	0.1
	Rajiformes (indet)	463	223	102	83	54	45	6	4	8	13	23	32
GBR Total		**508**	**290**	**168**	**153**	**101**	**77**	**46**	**34**	**34**	**30**	**45**	**56**
IRL	*Amblyraja radiata*	0.08			0.04		0.05						
	Raja brachyura	5	36	46	47	53	53	40	45	47	40	56	35
	Raja clavata	18	81	88	127	111	117	133	147	151	89	71	39
	Raja microocellata		0.15				0.06		0.30				
	Raja montagui						1	1	0.03	42	0	0	0.3
	Rajella fyllae		1		1								
	Rajiformes (indet)	983	429	259	236	79	49	53	38	43	59	21	14

Country	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IRL Total		**1007**	**547**	**394**	**410**	**243**	**219**	**227**	**230**	**284**	**188**	**148**	**87**
NLD	*Raja clavata*			0.05									
	Raja montagui		0.10										
	Rajiformes (indet)	0.39		0.08	0.11	0.02							
NLD Total		**0.39**	**0.10**	**0.14**	**0.11**	**0.02**							
NOR	Rajiformes (indet)	96	131	62	107	99	157	272	312	153	30	274	331
NOR Total		**96**	**131**	**62**	**107**	**99**	**157**	**272**	**312**	**153**	**30**	**274**	**331**
Grand Total		2783	1671	1052	919	600	594	714	770	729	731	639	

Table 18.4a. Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2019. *Leucoraja naevus*

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	6.a	3.341261	0.7631530	5.919370
2006	6.a	2.863412	1.5757870	4.151037
2007	6.a	4.253825	2.3167285	6.190920
2008	6.a	1.550122	0.7289567	2.371288
2009	6.a	2.234281	1.1018169	3.366745
2010	6.a	3.717024	2.0798635	5.354184
2011	6.a	1.785025	0.7836924	2.786359
2012	6.a	2.950243	1.4600642	4.440421
2013	6.a	3.500676	1.5592941	5.442058
2014	6.a	3.246034	0.4422661	6.049802
2015	6.a	0.672508	0.1433472	1.201669
2016	6.a	5.603120	2.7747450	8.431495
2017	6.a	2.360295	1.0888993	3.631690
2018	6.a	3.886602	1.8413575	5.391859
2019	6.a	1.06614	0.2529048	1.880343

Table 18.4b. Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2019. *Raja montagui*

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	6.&7.bj	3.8203644	0.8772230	6.763506
2006	6.&7.bj	3.5317143	1.7603041	5.303125
2007	6.&7.bj	3.1963185	0.2919647	6.100672
2008	6.&7.bj	2.4079747	1.1541523	3.661797
2009	6.&7.bj	5.0177595	2.1479083	7.887611
2010	6.&7.bj	4.5488637	2.5912639	6.506463
2011	6.&7.bj	6.4196486	3.4717450	9.367552
2012	6.&7.bj	4.0720115	2.3253288	5.818694
2013	6.&7.bj	7.1234651	3.6220724	10.624858
2014	6.&7.bj	9.4745773	3.9045792	15.044575
2015	6.&7.bj	5.9441076	2.9215481	8.966667
2016	6.&7.bj	15.3248874	-3.1670403	33.816815
2017	6.&7.bj	8.9378535	3.9548648	13.920842
2018	6.&7.bj	7.0109626	4.1531268	9.868798
2019	6.&7.bj	6.6001541	2.6351385	10.565170
2005	7.a,e-h	0.7459104	-0.2892318	1.781053
2006	7.a,e-h	3.6461218	0.9412191	6.351025
2007	7.a,e-h	11.1532172	0.8082230	21.498211
2008	7.a,e-h	6.9323503	0.6528146	13.211886
2009	7.a,e-h	8.0424664	2.1113381	13.973595
2010	7.a,e-h	9.9729479	4.0587944	15.887101
2011	7.a,e-h	6.7392692	2.3894273	11.089111
2012	7.a,e-h	7.8776726	3.1958581	12.559487
2013	7.a,e-h	15.4326483	3.1645578	27.700739
2014	7.a,e-h	16.5616727	4.2940963	28.829249
2015	7.a,e-h	20.3186235	7.1949131	33.442334
2016	7.a,e-h	30.2480582	9.2527723	51.243344
2017	7.a,e-h	12.8967985	4.9479571	20.845640
2018	7.a,e-h	31.8726703	8.768211	54.988519
2019	7.a,e-h	17.3224029	2.2585908	32.386217

Table 18.4c. Skates and rays in the Celtic Seas. Biomass estimates (kg per km²) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2017 *Raja brachyura*

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	7.a&7.g	0.6014534	-0.3335659	1.5364727
2006	7.a&7.g	0.1426726	-0.1369605	0.4223057
2007	7.a&7.g	1.7877288	-0.2675947	3.8430524
2008	7.a&7.g	3.7541867	-0.5016022	8.0099756
2009	7.a&7.g	0.0000000	0.0000000	0.0000000
2010	7.a&7.g	3.5534812	-0.3123857	7.4193480
2011	7.a&7.g	1.4430961	-1.3853203	4.2715125
2012	7.a&7.g	0.3881487	-0.2841718	1.0604693
2013	7.a&7.g	3.1461458	-1.1897411	7.4820327
2014	7.a&7.g	1.7142022	-0.4667081	3.8951125
2015	7.a&7.g	1.6050991	-0.2292067	3.4394049
2016	7.a&7.g	2.8149362	0.8451547	4.7847177
2017	7.a&7.g	2.2458713	-0.2734638	4.7652064

Table 18.4d. Skates and rays in the Celtic Seas. Biomass estimates (kg per km²) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2019. *Raja clavata*

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	6	3.7434568	-0.1480331	7.634947
2006	6	5.9180334	2.4861426	9.349924
2007	6	5.5667234	1.2599530	9.873494
2008	6	7.6147167	2.7638518	12.465582
2009	6	7.2688409	2.7567736	11.780908
2010	6	17.9536507	3.7574574	32.149844
2011	6	13.7808323	4.9685941	22.593070
2012	6	22.8984537	3.2988192	42.498088
2013	6	15.6807027	3.5229155	27.838490
2014	6	12.8470955	1.3826824	24.311508
2015	6	14.3399433	4.0199724	24.659914
2016	6	23.3694853	3.6320664	43.106904
2017	6	15.7783305	7.1192277	24.437433
2018	6	16.21579	5.766965	26.66462
2019	6	16.16309	3.665837	28.66034
2005	7.fg	0.4852387	-0.2500962	1.220573
2006	7.fg	1.1089902	0.1300639	2.087916
2007	7.fg	2.9643871	-0.5731053	6.501880
2008	7.fg	4.3403369	0.5933405	8.087333
2009	7.fg	2.3340468	0.0567745	4.611319
2010	7.fg	4.0709832	-0.4147746	8.556741
2011	7.fg	1.3215369	-0.1738435	2.816917

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2012	7.fg	1.3579023	0.1158664	2.599938
2013	7.fg	2.6173275	-0.5230054	5.757660
2014	7.fg	2.9940930	-0.8974523	6.885638
2015	7.fg	5.3633727	-1.3119085	12.038654
2016	7.fg	5.7414410	0.8802873	10.602595
2017	7.fg	4.5903049	0.2296374	8.950972
2018	7.fg	16.2207595	-4.1526061	36.594125
2019	7.fg	15.5212348	-7.0479097	38.090379

Table 18.4e. Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2017. ***Raja microocellata***

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	ICES.27.f-g	0.0000000	0.0000000	0.000000
2006	ICES.27.f-g	2.0380292	-0.5532546	4.629313
2007	ICES.27.f-g	6.9088751	-1.5846139	15.402364
2008	ICES.27.f-g	4.3341235	-0.8869290	9.555176
2009	ICES.27.f-g	0.4155238	-0.3988879	1.229935
2010	ICES.27.f-g	1.5024740	0.0586864	2.946262
2011	ICES.27.f-g	0.7145779	-0.2626957	1.691851
2012	ICES.27.f-g	0.7511249	-0.0690751	1.571325
2013	ICES.27.f-g	1.7806495	-0.5969467	4.158246
2014	ICES.27.f-g	1.8007968	-0.2077030	3.809297
2015	ICES.27.f-g	2.3359211	-0.2738192	4.945661
2016	ICES.27.f-g	4.8460490	-0.8374794	10.529577
2017	ICES.27.f-g	3.3718040	-1.3905964	8.134204

Table 18.4f. Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the IGFS-IBTS-Q4 survey, 2005–2017. *Dipturus batis* and *Dipturus intermedius* combined.

Year	MgtArea	CatchWgtKg	ci_l	ci_u
2005	6&7	0.0647826	0.0190203	0.1105449
2006	6&7	0.3803152	-0.1784847	0.9391151
2007	6&7	0.4278930	-0.0545232	0.9103092
2008	6&7	0.2876187	0.0512355	0.5240019
2009	6&7	0.6405827	0.2032358	1.0779296
2010	6&7	1.8904779	-0.7308948	4.5118505
2011	6&7	1.0733361	-0.4062287	2.5529008
2012	6&7	0.5850637	-0.0695271	1.2396545
2013	6&7	0.6888536	-0.1227879	1.5004950
2014	6&7	0.9398314	0.2384340	1.6412288
2015	6&7	1.2567201	-0.2500285	2.7634687
2016	6&7	3.0762427	-0.7613029	6.9137883
2017	6&7	1.3970494	0.4835118	2.3105869

Table 18.5.a Skates and rays in the Celtic Seas. Biomass estimates (kg per km²) of assessed stocks from the EngW-BTS-Q3survey, 1993–2019. *Leucoraja naevus*

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
1993	1.56521739130	0.52982863558	0.2805495930	0.0442842637811807	0.516814922276976
1994	1.77319587629	1.04003396257	0.7334581518	0.255944970691577	1.21097133299459
1995	1.47368421053	0.75033705626	0.4677081143	0.152967004783638	0.78244922382522
1996	1.34736842105	0.52752584593	0.2235253609	0.0657496362671409	0.381301085531509
1997	1.04166666667	0.62398083107	0.4688399162	0.177106476705209	0.760573355751368
1998	1.11578947368	0.48797411904	0.3366904448	0.126043026622171	0.547337863018201
1999	1.75257731959	0.62025928533	0.3341620085	0.105561701344976	0.562762315631701
2000	0.77419354839	0.34581151869	0.2136636726	0.042825637411439	0.384501707751048
2001	1.23711340206	0.61262233340	0.3662549007	0.0992685621795624	0.633241239311363
2002	0.90721649485	0.29903132493	0.1755475901	0.0175064378334215	0.33358874240162
2003	0.92783505155	0.39221405069	0.1679077790	0.0262139087699609	0.309601649151603
2004	1.62500000000	0.54193525081	0.2937186798	0.0801618314712677	0.507275528041643
2005	1.18750000000	0.32954286995	0.1059840317	-0.000160594150776891	0.212128657461432
2006	1.03092783505	0.39647977524	0.1747113090	0.0288583372952765	0.320564280769945
2007	0.93814432990	0.25896622815	0.1102983617	0.010230066	0.210366657606129
2008	0.83395368073	0.41111740358	0.2356705480	0.0373184470793527	0.434022648946133
2009	1.12371134021	0.44097103364	0.2335070236	0.0762954197181952	0.390718627423286
2010	0.62680412371	0.21588113112	0.1294880295	0.0265076007221258	0.232468458372572
2011	0.91666666667	0.55271097883	0.3430747783	-0.00680560006257896	0.692955156675061
2012	0.35051546392	0.11366297453	0.0364605049	-0.0141769728420077	0.087097982683541
2013	0.93377804730	0.38921658365	0.1876143532	0.0310599230436659	0.344168783306712
2014	1.05154639175	0.51116982099	0.3208873025	0.0674088850923328	0.574365719825336
2015	1.03092783505	0.39520473890	0.1659941506	0.0369212295225414	0.295067071707776

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
2016	0.76041666667	0.27223255869	0.1582434638	0.0420232314319602	0.274463696250751
2017	1.95876288660	0.61370861183	0.2052931051	0.0420057713005318	0.36858043881331
2018	1.35638108781	0.57054229751	0.2407238375	0.0582669413476327	0.423180733659662
2019	1.49484536082	0.40489194792	0.2015715687	0.0573084289063442	0.345834708416645

Table 18.5.b Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the EngW-BTS-Q3 survey, 1993–2019. *Raja brachyura*

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
1993	0.217391304	0.202926914	0.1269785836	-0.121899440248866	0.375856607434004
1994	0.350515464	0.361539579	0.2963169361	-0.100733695783894	0.693367568006567
1995	0.547368421	0.397228064	0.2778342108	-0.121228001980977	0.676896423679628
1996	0.440789474	0.409321646	0.3553740338	-0.341159072440811	1.05190714002583
1997	0.3125	0.493632623	0.4572130518	-0.224165215645465	1.13859131932599
1998	0.505263158	0.129420715	0.0194946045	-0.0187148203143261	0.0577040293025053
1999	0.762886598	0.394825795	0.2846356009	-0.00895801507297511	0.578229216815799
2000	1.075268817	0.582969453	0.3930191447	-0.220810888161398	1.00684917752671
2001	0.494845361	0.412723449	0.3434749047	-0.2829971762864	0.969946985605843
2002	0.494845361	0.299473316	0.2239284140	-0.0597034924687173	0.50756032043775
2003	0.721649485	0.38135805	0.2443274004	-0.120102453805645	0.608757254704531
2004	1.555107527	0.405724904	0.1163696564	-0.0690933611217857	0.3018326738845
2005	0.729166667	0.549357866	0.4514023829	-0.0329761484911724	0.935780914293191
2006	0.680412371	0.43926959	0.3411269119	0.0224205363826027	0.659833287424341
2007	0.298969072	0.341527271	0.2990834993	-0.0251190520518924	0.623286050561146
2008	0.82382134	0.543261632	0.4293160170	0.029151930618002	0.829480103302409

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
2009	1.00631859	0.621417119	0.4038532044	-0.00588657755331884	0.813592986274869
2010	0.865979381	0.664957836	0.5157203044	-0.0512517224828438	1.08269233137111
2011	0.962797619	0.749734494	0.5862340720	0.0200404223039115	1.1524277217281
2012	0.995965935	0.371753292	0.1678020905	0.0226252586606098	0.312978922253435
2013	1.308341143	0.560809875	0.3343264204	-0.0420678318695744	0.710720672665972
2014	1.43814433	0.975914777	0.6960153016	-0.106608047107129	1.49863865037693
2015	0.546391753	0.370785528	0.3120654187	0.0430321343678158	0.581098703023767
2016	1.797899763	0.81388907	0.4579647396	-0.150124239977276	1.06605371927591
2017	1.68556701	0.802985092	0.5009889535	0.0207258672167689	0.98125203982872
2018	1.637419282	0.935668638	0.6190722244	0.137965095972936	1.10017935278895
2019	1.696996862	1.499832444	1.2118232393	0.334280453178965	2.089366025

Table 18.5.c Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the EngW-BTS-Q3survey, 1993–2019. *Raja clavata*

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
1993	3.394409938	2.147491981	1.2590820157	0.413465781	2.10469825044543
1994	2.515463918	1.91860878	1.3790681051	0.63622310148291	2.12191310864556
1995	3.650526316	3.083750445	2.1707238568	1.01555101869268	3.32589669485941
1996	3.962250454	2.659898324	1.7368462209	0.88840333836426	2.58528910350775
1997	4.915331808	2.752639735	1.7154046251	0.673410024004365	2.75739922614728
1998	3.768421053	2.909342987	2.2297194547	1.1887271850968	3.27071172434858
1999	3.399957921	2.512642946	1.8729774437	0.964059960464536	2.78189492696201
2000	3.032258065	1.795110911	1.1668489537	0.485838126889403	1.84785978049978
2001	5.274601687	3.091158416	1.8853662673	0.87187231397991	2.89886022057109
2002	3.572164948	2.694867056	1.8217361065	1.02025455739767	2.62321765560088
2003	3.773195876	2.781402086	2.0496492685	1.09208441586155	3.0072141210445
2004	6.10745614	5.439657812	4.3672541592	0.884130761842763	7.85037755647463
2005	4.068452381	2.64219045	1.6877686689	0.893344433788855	2.48219290406433
2006	4.762886598	2.796041763	1.8118351578	0.806923364003368	2.81674695169522
2007	5.340206186	2.626815277	1.4684218749	0.740072829193358	2.19677092065786
2008	5.499922082	3.112719231	2.0562069357	1.05079932495056	3.06161454638711
2009	6.195298614	3.80590701	2.6161785245	1.62099099226411	3.61136605666566
2010	7.506896552	3.956040131	2.5807912526	1.62204003971039	3.53954246546399
2011	7.494276557	3.35495877	1.7946347953	1.04531741403541	2.54395217648489
2012	8.279772485	3.669060669	1.9290772487	1.22966112433634	2.62849337307193
2013	12.07999063	5.273265802	3.2558764288	2.1004684638374	4.4112843938569
2014	9.032349804	5.381660099	3.4214251798	2.14405489138188	4.69879546824112
2015	9.261878328	4.118343152	2.1751071033	1.25747412558516	3.09274008107204
2016	13.86401285	7.261015872	4.6353006357	2.97200526590177	6.29859600545403

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
2017	13.08247423	8.163355637	5.4703248523	3.69235371460706	7.24829598994847
2018	16.87255013	10.03634576	6.7907215633	4.41007716869564	9.17136595788654
2019	15.61168385	10.11636979	6.9588077026	4.76673558679735	9.15087981832416

Table 18.5.d Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the EngW-BTS-Q3survey, 1993–2019. *Raja microocellata*

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
1993	0.848484848	1.209323294	1.054986582	0.153682658637028	1.95629050537132
1994	1.272727273	2.184432188	1.882180765	0.44001180511436	3.32434972469539
1995	2.679435484	2.94074998	2.26960381	0.315474599845468	4.22373301928702
1996	1.575757576	0.864876196	0.529097288	-0.02183554638712	1.08003012243971
1997	2.394021739	2.91835051	2.294425932	0.775885312637334	3.81296655076254
1998	5.096774194	3.77811973	2.557688943	0.66331962705189	4.45205825847978
1999	3.181818182	3.322263435	2.542161923	1.07022307698618	4.01410076960205
2000	2.375	1.615072133	0.823467294	0.153737439072618	1.49319714801453
2001	2.848484848	2.732879935	1.902478669	0.3974389700647	3.40751836804715
2002	2.666666667	2.88657629	2.316377473	1.07386552201255	3.55888942458746
2003	2.060606061	1.90542341	1.316221172	0.249155610552703	2.38328673250998
2004	3.458211144	2.407014926	1.600518256	0.166629823242332	3.03440668818799
2005	2.181818182	2.330122503	1.750538876	0.557089063336891	2.94398868825122
2006	2.909090909	1.495921372	0.514081152	0.0803558601456727	0.947806444423408
2007	2.787878788	1.451565151	0.535629664	0.0309380937003715	1.04032123399294
2008	2.484848485	1.145102729	0.512381043	0.127876518709268	0.896885567510747
2009	3.086999022	1.849703514	0.774428227	0.126689058847372	1.42216739551718

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
2010	2.121212121	1.599401064	1.061746829	-0.047396509885677	2.17089016888035
2011	2.909090909	1.619131371	0.785369001	0.0510074158220799	1.51973058586688
2012	2.848484848	1.498667667	0.582842161	0.109941334286113	1.05574298775392
2013	1.052341598	0.625881192	0.284645797	-0.0426558421948529	0.611947436073969
2014	1.393939394	1.128631343	0.656546592	-0.264119299361096	1.5772124840215
2015	2.03030303	0.885628953	0.347916736	-0.165833969250302	0.861667441138694
2016	1.818181818	1.019499503	0.577420556	0.0330601524766504	1.12178095905603
2017	2.909090909	2.097341849	1.601173865	0.435791288563933	2.76655644172408
2018	1.818181818	0.986748046	0.596929422	-0.0927325829212117	1.28659142687332
2019	1.696969697	0.796677248	0.426715474	-0.253315586662374	1.106746535

Table 18.5.e Skates and rays in the Celtic Seas. Biomass estimates (kg per km^2) of assessed stocks from the EngW-BTS-Q3survey, 1993–2019. *Raja montagui*

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
1993	2.178571429	0.90029457	0.520218282	0.218798183520085	0.821638380964473
1994	1.75257732	0.503657603	0.23035323	0.00430983199998111	0.456396627357119
1995	2.294736842	1.078310211	0.620751317	0.207901040913339	1.03360159274587
1996	2.525	1.150903064	0.697683821	0.16307943578072	1.23228820600648
1997	2.625	1.031405373	0.456071723	0.0919425025287939	0.82020094332244
1998	2.463157895	0.63428519	0.16645206	0.0123752355459547	0.320528883790338
1999	3.600673259	1.105423094	0.555816369	0.0720010815674258	1.03963165597383
2000	3.247311828	0.891819124	0.304454718	0.0703923633034616	0.538517073270863
2001	3.690721649	1.245088983	0.453343222	0.16024496413256	0.746441479048517
2002	2.907216495	1.150581829	0.588692078	0.203598071456954	0.973786085301882

	CPUE	CPUE	CPUE >= 50 cm Biomass (cpue50Bio)		
	number per hour	kg per hour	*kg per hour	lower.limit.cpue50Bio	upper.limit.cpue50Bio
2003	4	1.164384444	0.518745742	0.155183845174848	0.882307638431262
2004	6.020863881	1.540221813	0.584668684	0.258296280410702	0.911041087056985
2005	3.541666667	0.827420962	0.249555302	0.0872972367407633	0.411813366273292
2006	3.75257732	0.924950159	0.358054847	0.100553638411379	0.615556055523183
2007	3.845360825	0.933987796	0.293934214	0.0916224682777713	0.496245959194955
2008	3.533498759	0.626686138	0.14300261	0.000363752090806524	0.285641467355756
2009	6.72098437	1.359021015	0.405700873	0.158426951552838	0.652974794927287
2010	4.80277284	0.956285843	0.302139811	0.123399238494817	0.480880382906739
2011	6.673076923	1.421489316	0.544080268	0.246679421676543	0.841481113691902
2012	6.855670103	1.434502784	0.463806671	0.161814393878736	0.765798947153376
2013	6.643321021	1.328184501	0.419966683	0.0483476411734473	0.791585725663408
2014	5.795287187	1.609628662	0.629324963	0.24418245634209	1.01446746967077
2015	7.131007137	1.654251887	0.564607541	0.264028564632995	0.865186517221544
2016	9.475701487	1.94611284	0.582808716	0.207020438084674	0.958596993974756
2017	11.76701031	2.161968681	0.552997854	0.244861583689981	0.861134124349811
2018	7.046491369	1.601816723	0.555855746	0.2191214703661	0.892590022338879
2019	8.893993725	1.811037126	0.53968153	0.140480417267283	0.938882642973455

Figure 18.1a. Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) in the Celtic Seas (ICES subareas 6–7 including 7.d), from 1903–2015 (Source: Official nominal catches https://www.ices.dk/data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx).

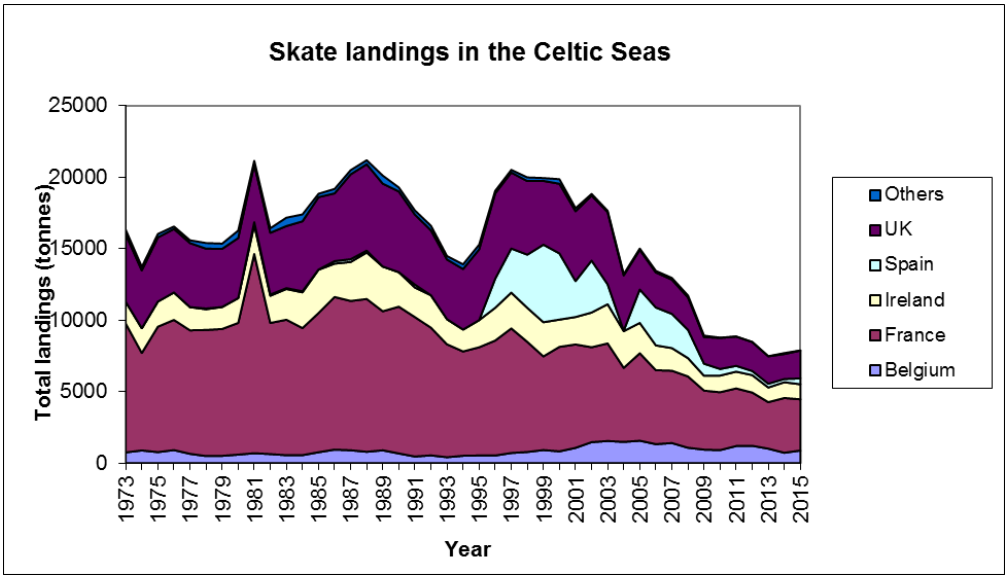

Figure 18.1b. Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) by nation in the Celtic Seas from 1973–2015 (Source: Official nominal catches https://www.ices.dk/data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx).

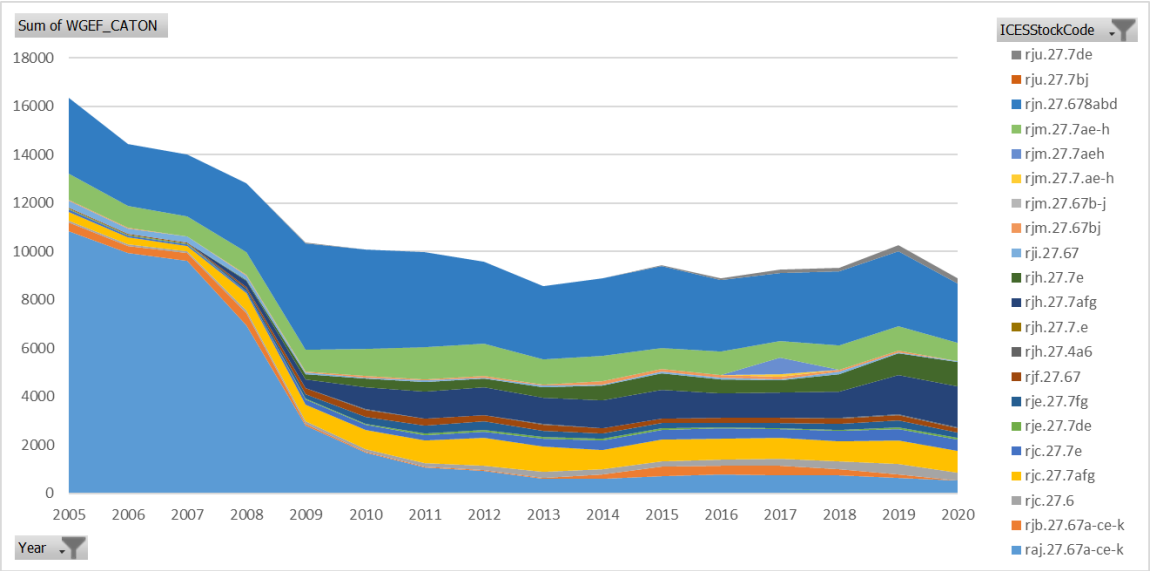

Figure 18.1.c Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) by stock in the Celtic Seas from 2005–2020 (Source: ICES).

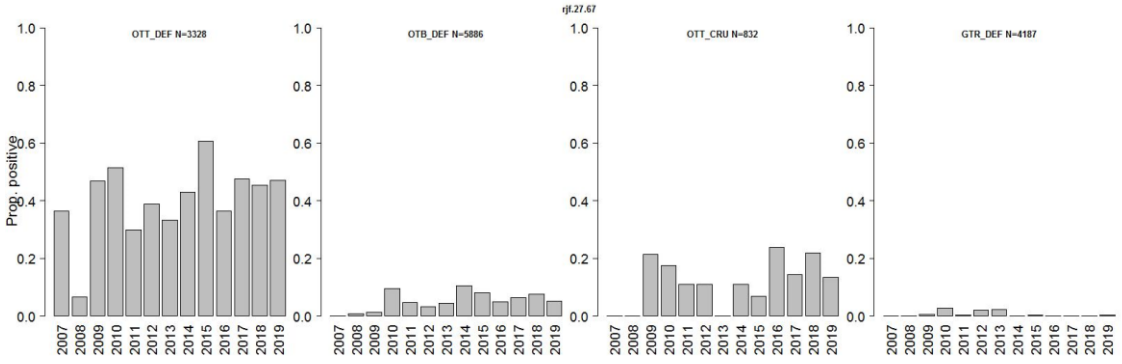

Figure 18.2 Skates and rays in the Celtic Seas. Temporal trends in the proportion of hauls encountering RJF.27.67, based on French on-board observer trips carried out in application of EU data collection programmes.

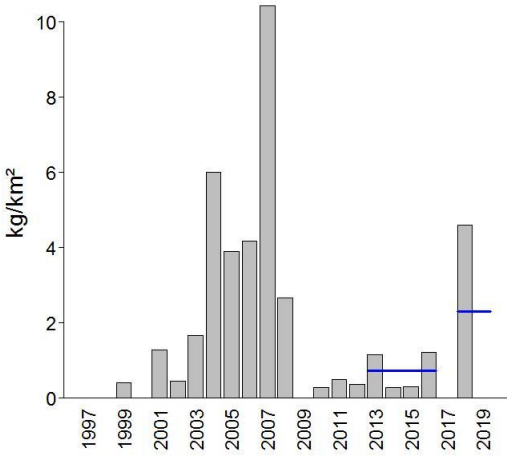

Figure 18.3a. Exploitable biomass (individuals >= 50 cm) per km² of *Leucoraja circularis* in Subarea 7 (stock rji.27.67) from the FR-EVHOE survey (1997–2019, no survey in 2017). Blue lines indicate mean annual biomass for 2018–2019 and for 2013–2016.

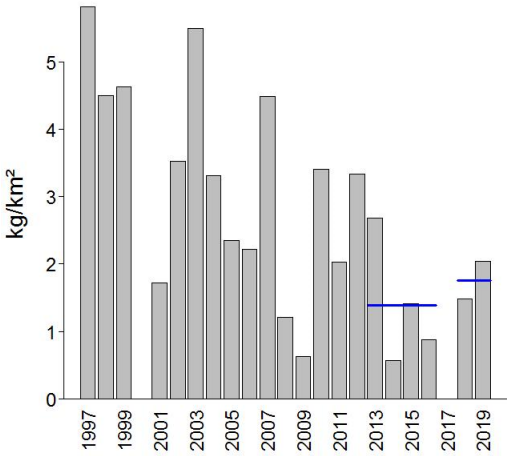

Figure 18.3b. Exploitable biomass (individuals >= 50 cm) per km² of *Leucoraja fullonica* in Subarea 7 (stock rjf.27.67) from the FR-EVHOE survey (1997–2019, no survey in 2017). Blue lines indicate mean annual biomass for 2018–2019 and for 2013–2016.

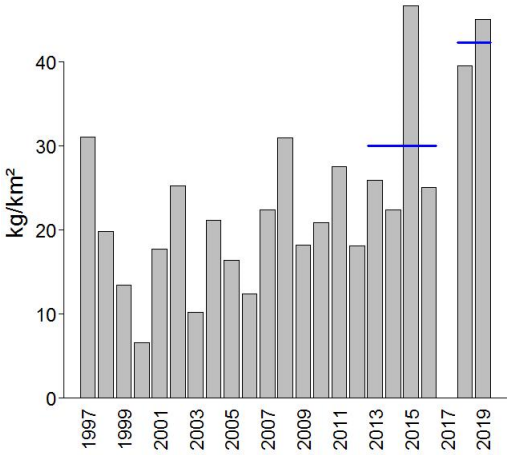

Figure 18.3c. Skates and rays in the Celtic Seas. Exploitable biomass (individuals >= 50 cm) per km² of *Leucoraja naevus* in subareas 6 and 7 from the FR-EVHOE survey (1997–2019, no survey in 2017). Blue lines indicate mean annual biomass for 2018–2019 and for 2013–2016.

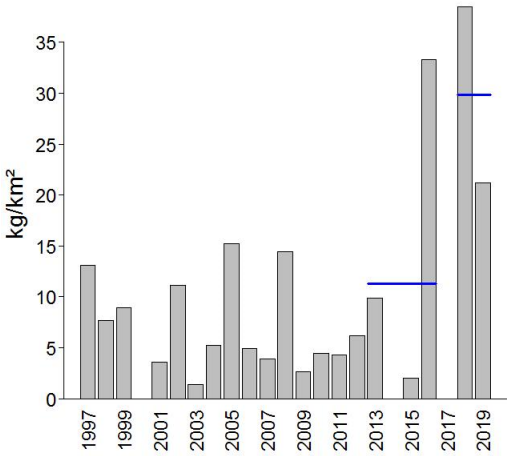

Figure 18.3d. Skates and rays in the Celtic Seas. Exploitable biomass (individuals >= 50 cm) per km² of *Raja clavata* in areas of the stock rjc.27.7afg covered by the FR-EVHOE survey (1997–2019, no survey in 2017). Blue lines indicate mean annual biomass for 2018–2019 and for 2013–2016.

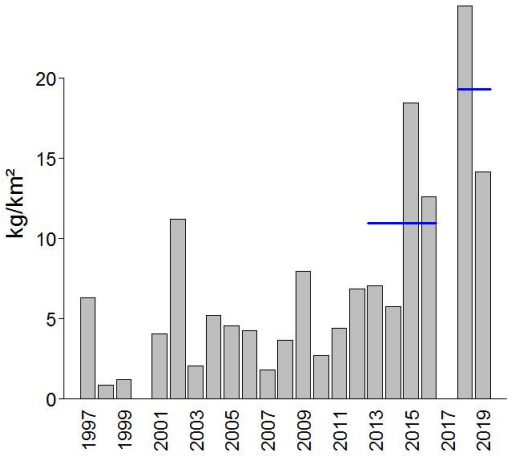

Figure 18.3e. Skates and rays in the Celtic Seas. Exploitable biomass (individuals >= 50 cm) per km² of *Raja montagui* in Subareas 7 (stock rjc.27.7ae-h) from the FR-EVHOE survey (1997–2019, no survey in 2017). Blue lines indicate mean annual biomass for 2018–2019 and for 2013–2016.

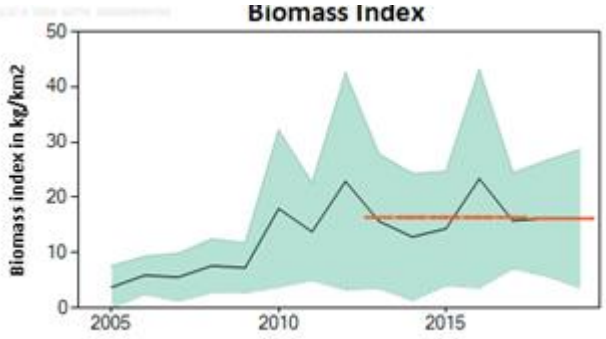

Figure 18.4a. Skates and rays in the Celtic Seas. Irish Groundfish Survey (IGFS-WIBTS-Q4) biomass index of *Raja clavata* in Division 6.a for 2005–2015. Red lines give average for 2013–2017 and for 2018–2019.

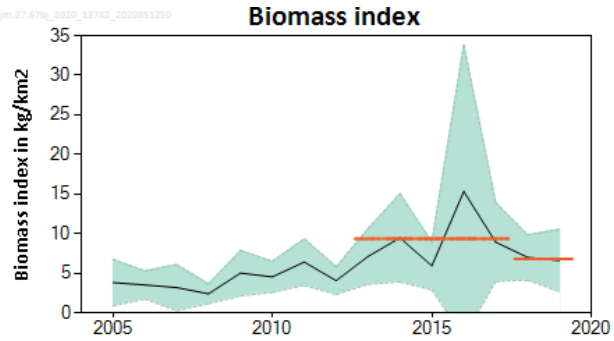

Figure 18.4b. Skates and rays in the Celtic Seas. Irish Groundfish Survey (IGFS-WIBTS-Q4) mean CPUE of *Raja montagui* in Divisions 6.a and 7.b-c for 2005–2019. Red lines give average for 2013–2017 and for 2018–2019.

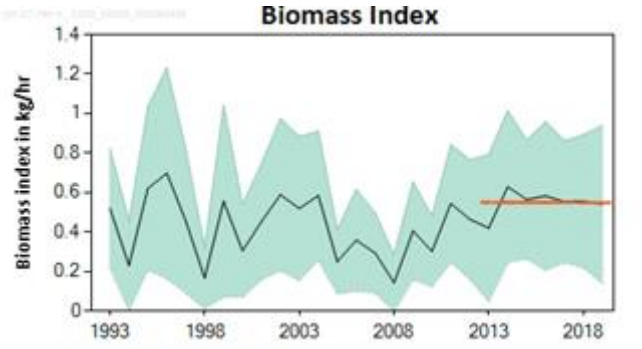

Figure 18.4c. Skates and rays in the Celtic Seas. UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3) mean CPUE of *Raja montagui* in Divisions 7.a, e-h for 1993–2019. Red lines give average for 2013–2017 and for 2018–2019.

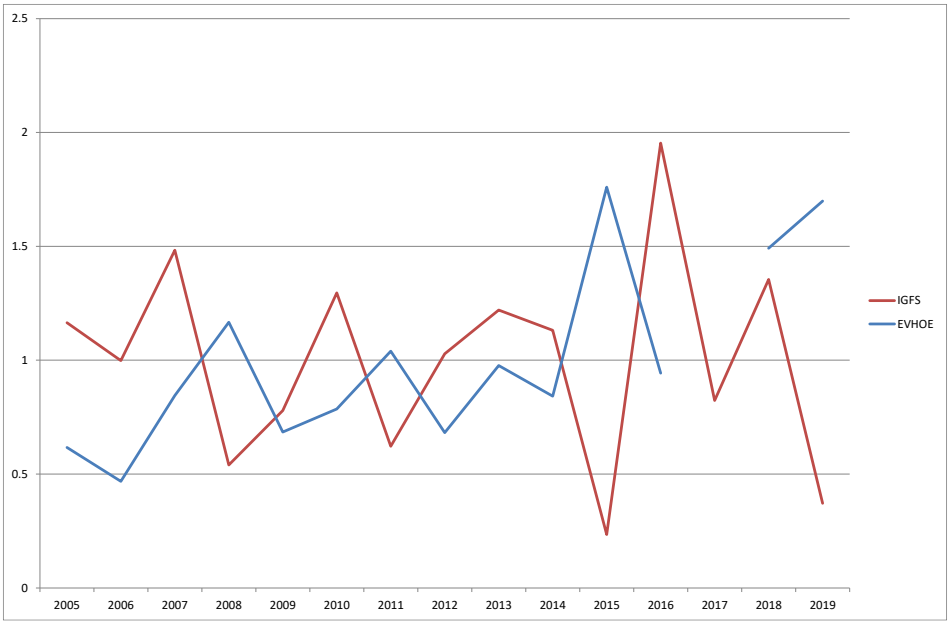

Figure 18.4d. Skates and rays in the Celtic Seas. Irish Groundfish Survey (IGFS-WIBTS-Q4) (red) and French EVHOE survey (blue) standardized biomasses for of *Leucoraja naevus* in divisions 6, 7, 8.abd. 2005–2019. The French survey did not take place in 2017.

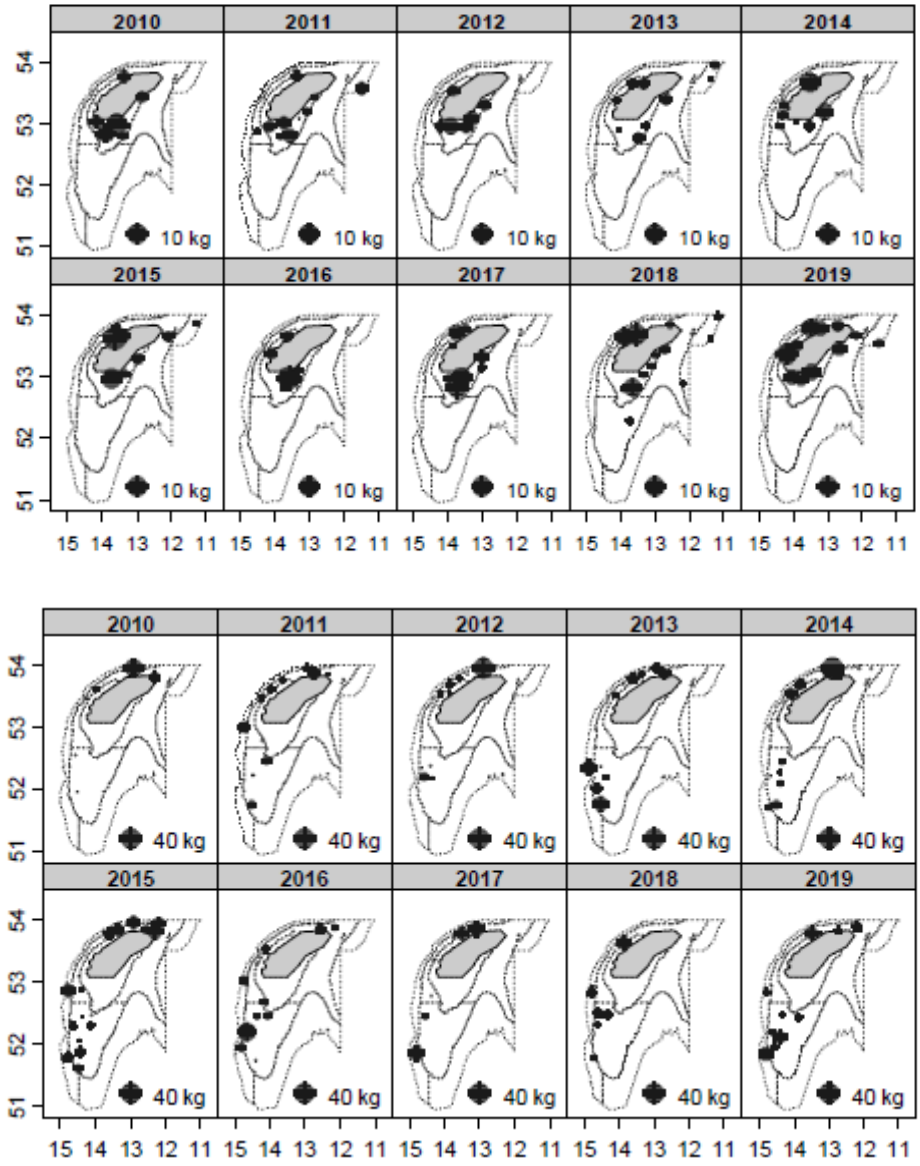

Figure 18.5a. Skates and rays in the Celtic Seas. Geographical distribution of cuckoo ray *Leucoraja naevus* (top) and sandy ray *Leucoraja circularis* (bottom) catches (kg haul^{-1}) in Porcupine survey time-series (2009–2019) (WD02 - Ruiz-Pico *et al.*, 2020).

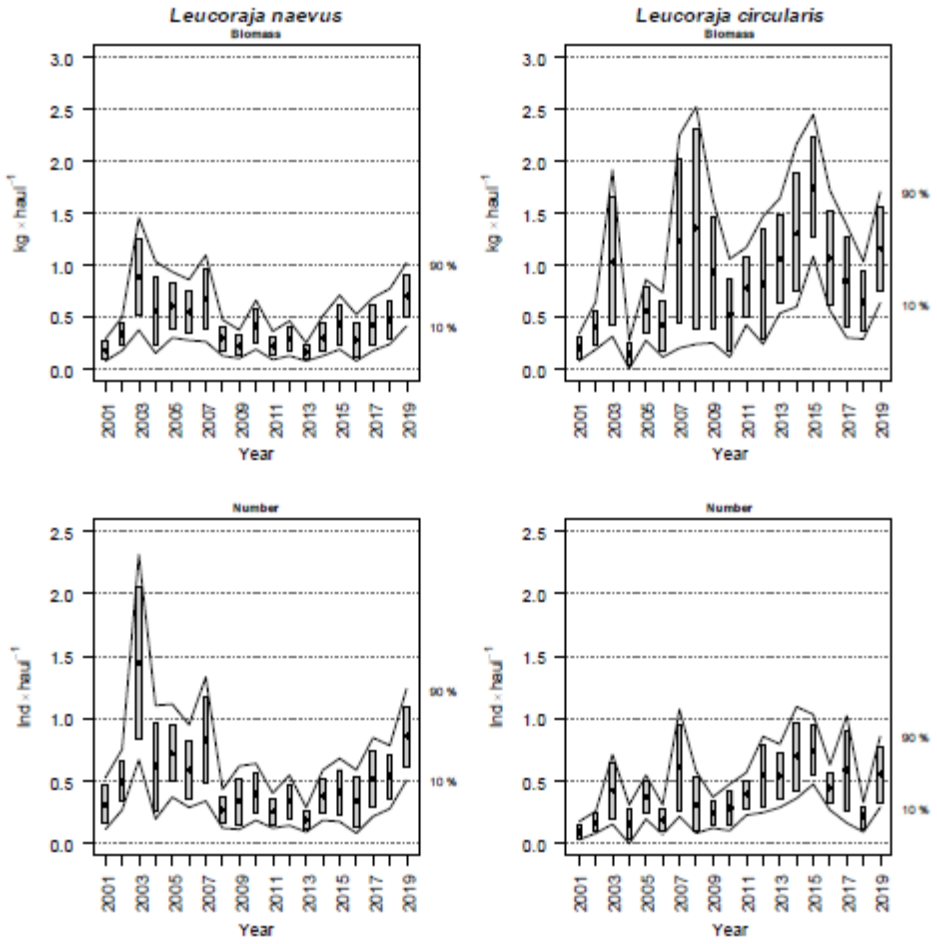

Figure 18.5b. Skates and rays in the Celtic Seas. Temporal changes of cuckoo ray *Leucoraja naevus* and sandy ray *Leucoraja circularis* biomass index (kg haul^{-1}) during Porcupine survey time-series (2001–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD02 - Ruiz-Pico *et al.*, 2020).

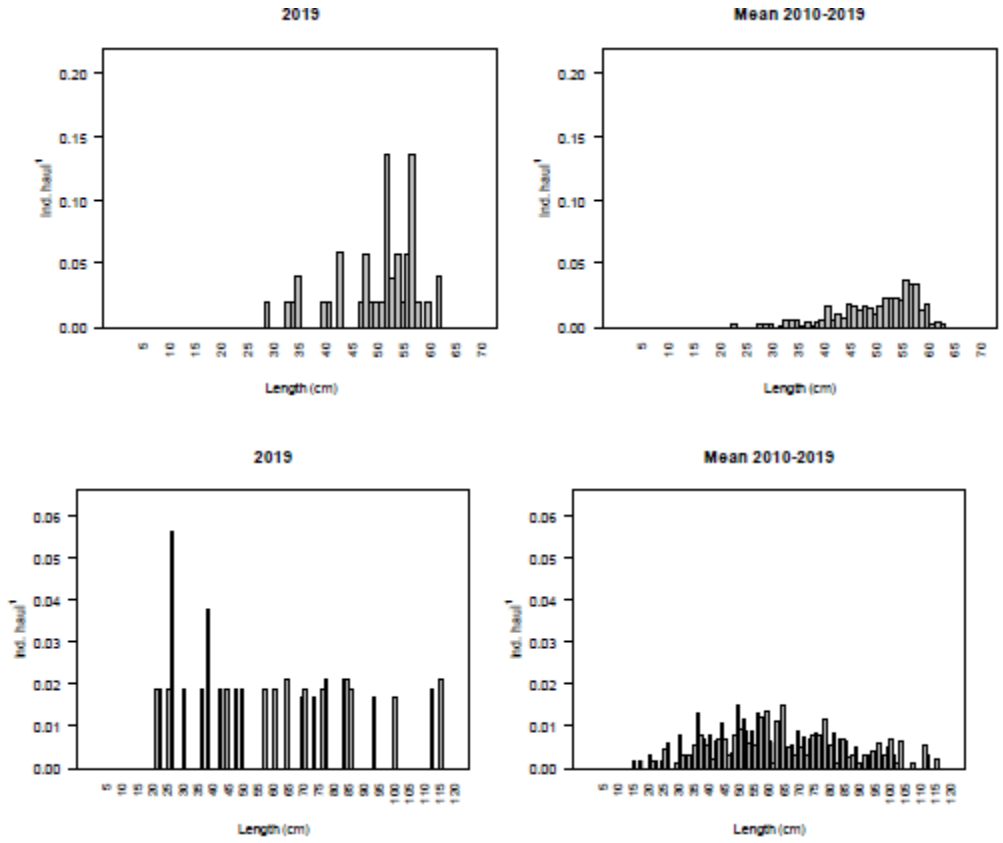

Figure 18.5c. Skates and rays in the Celtic Seas. Stratified length distributions of cuckoo ray *Leucoraja naevus* (top) and sandy ray *Leucoraja circularis* (bottom) in Porcupine survey 2001–2019 (WD02 - Ruiz-Pico *et al.*, 2020).

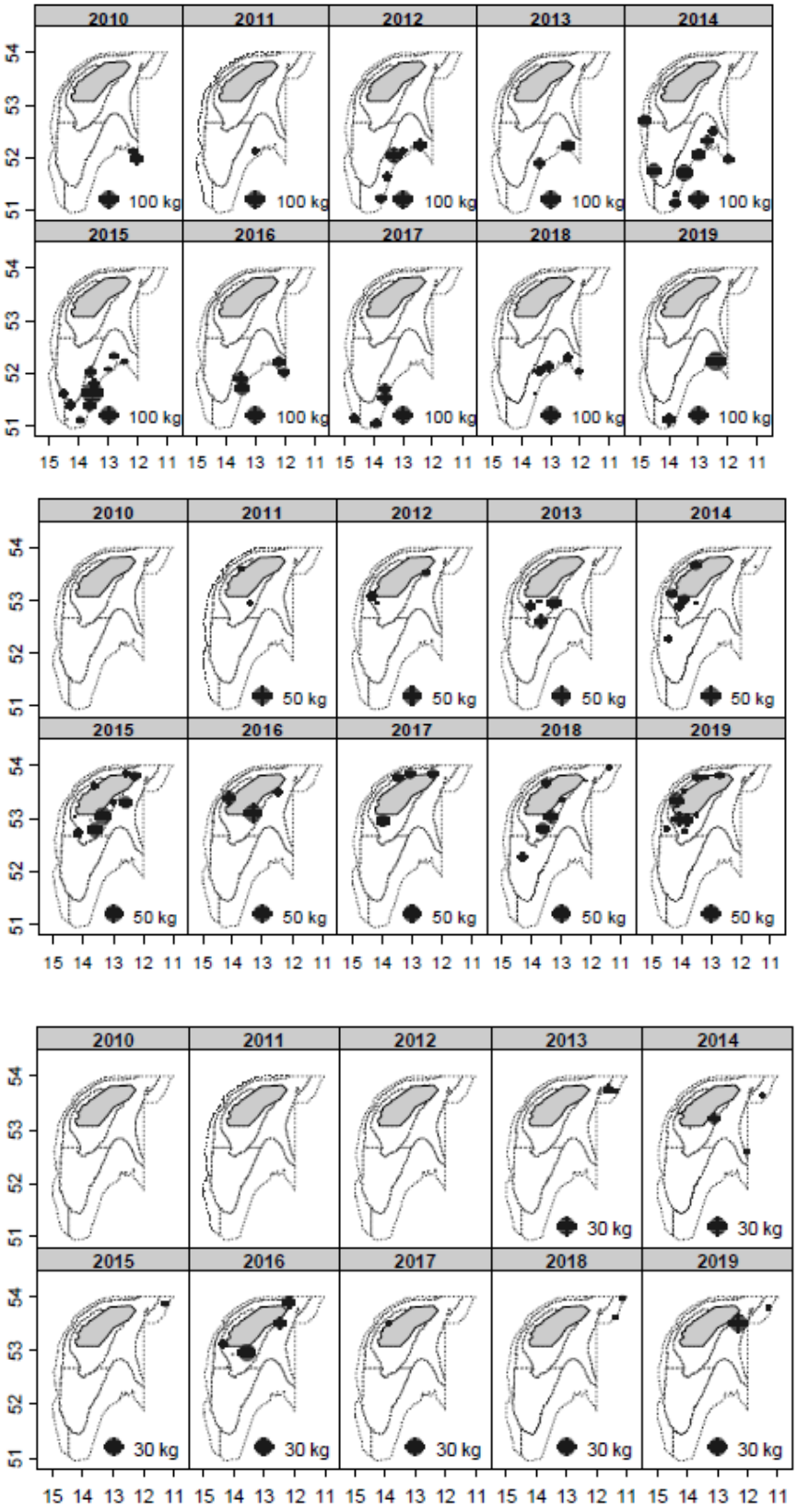

Figure 18.5d. Skates and rays in the Celtic Seas. Geographical distribution of *Dipturus nidarosiensis* (top), *D. batis* (middle) and *D. intermedius* (bottom) (kg haul^{-1}) in Porcupine survey time-series (2008–2019) (WD02 - Ruiz-Pico *et al.*, 2020).

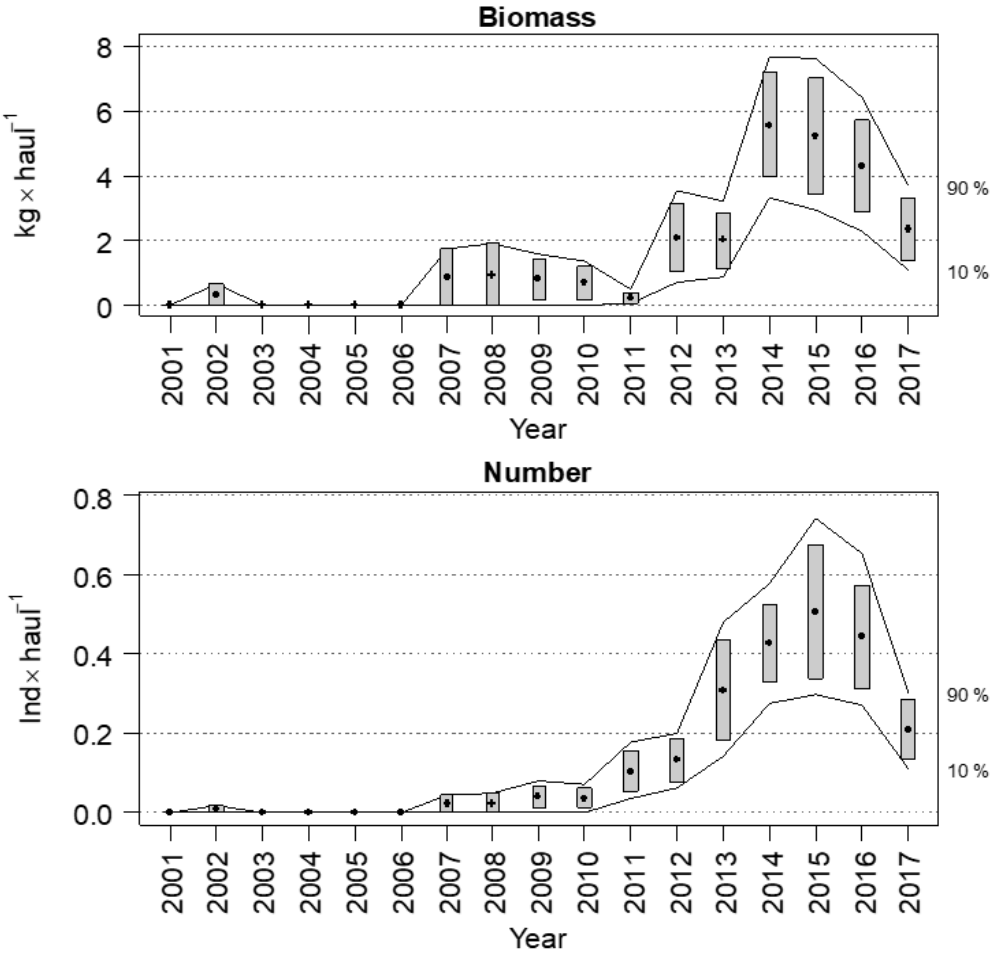

Figure 18.5f. Skates and rays in the Celtic Seas. Changes in *Dipturus* spp. biomass index (kg·haul^{-1}) during Porcupine survey time-series (2001–2017). Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD02 - Ruiz-Pico *et al.*, 2020).

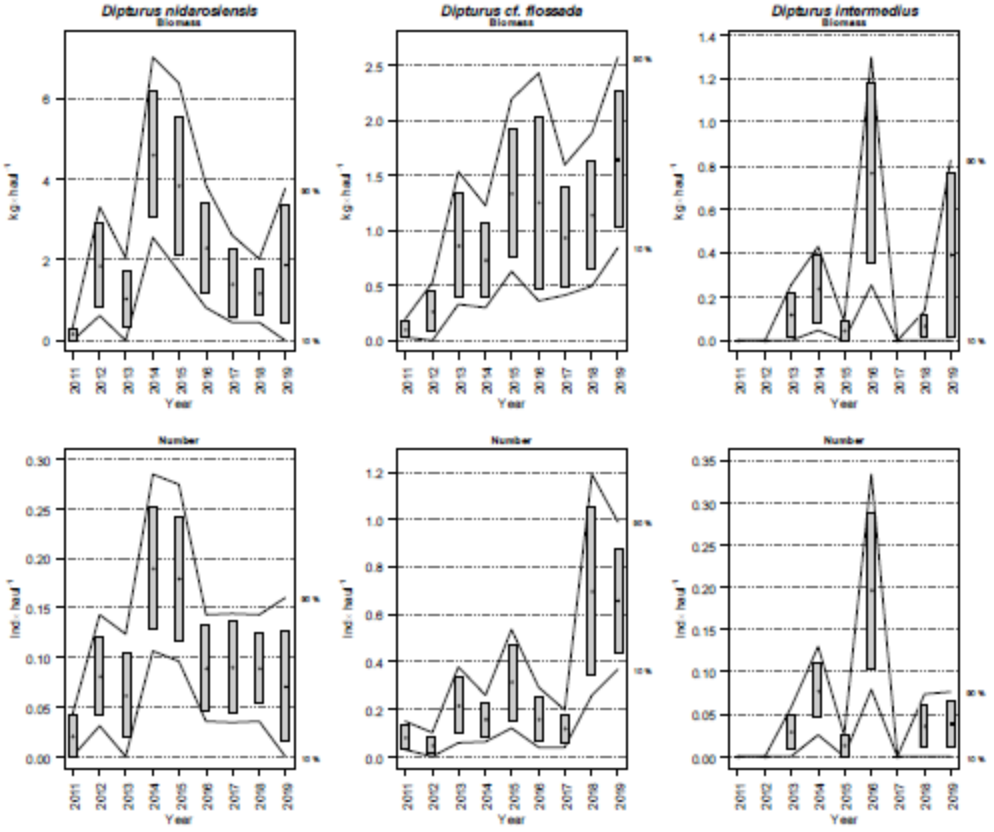

Figure 18.5g. Skates and rays in the Celtic Seas. Changes in *Dipturus nidarosiensis*, *Dipturus batis* (labelled *Dipturus* cf. *flossada*) and *Dipturus intermedius* (labelled *Dipturus* cf. *intermedia*) biomass index (kg haul^{-1}) during Porcupine survey time-series (2011–2019). Boxes mark parametric standard error of the stratified index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD02 - Ruiz-Pico *et al.*, 2020).

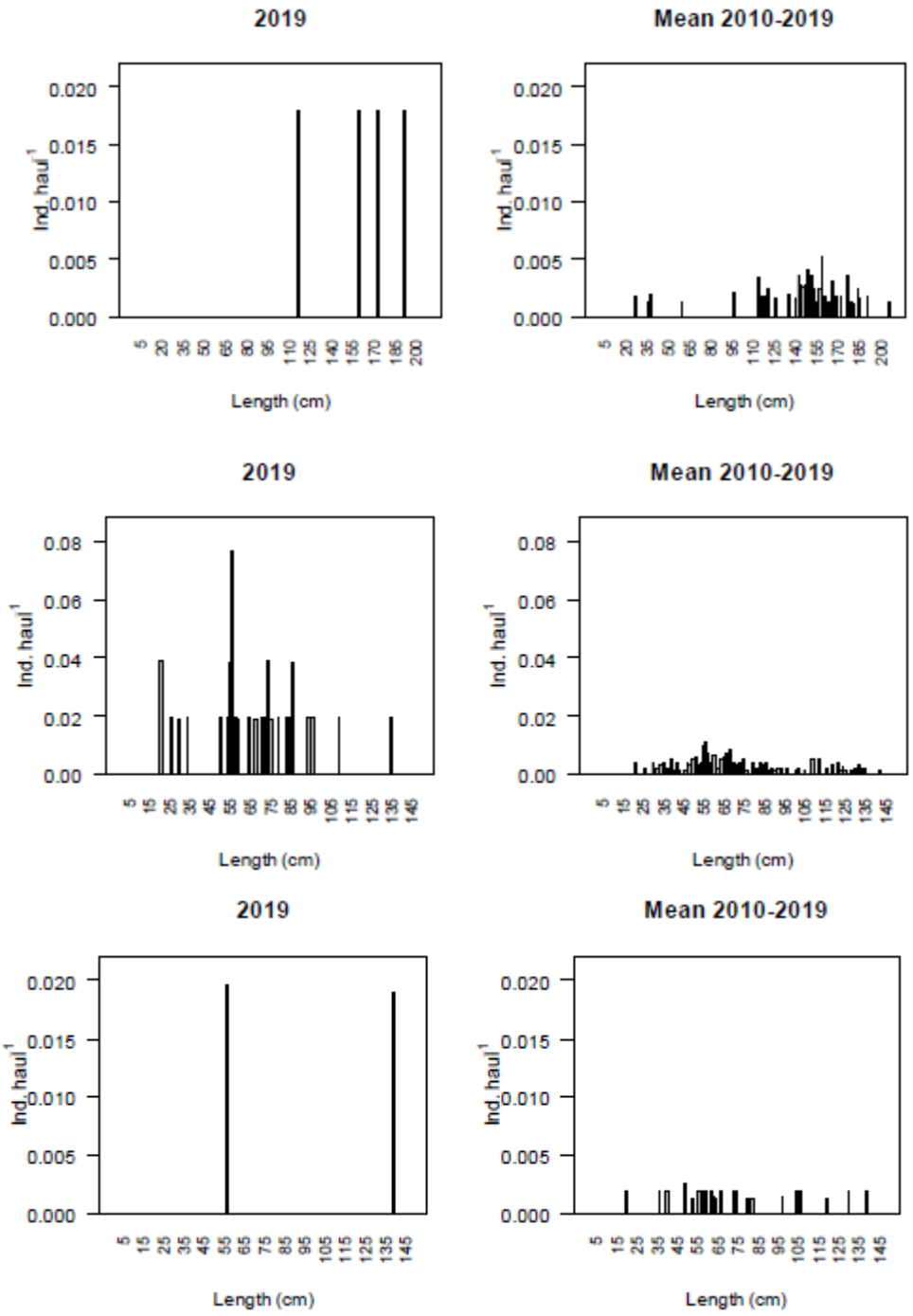

Figure 18.5h. Skates and rays in the Celtic Seas. Mean stratified length distributions of *Dipturus nidarosiensis* (top) and *Dipturus batis (*middle) and *D. intermedius* (bottom) from 2019 Porcupine surveys (WD02 - Ruiz-Pico *et al.*, 2020).

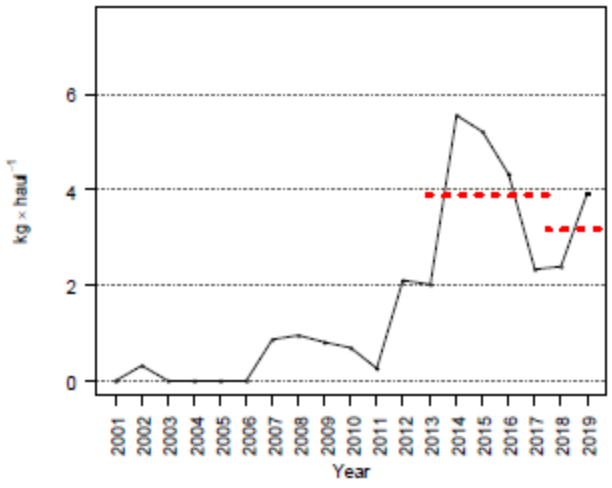

Figure 18.5i. Skates and rays in the Celtic Seas. Changes in *Dipturus* spp. biomass index during Porcupine survey time series (2001–2019). Dotted lines compare mean stratified biomass in the last two years and in the five previous years. (WD02 - Ruiz-Pico *et al.*, 2020).

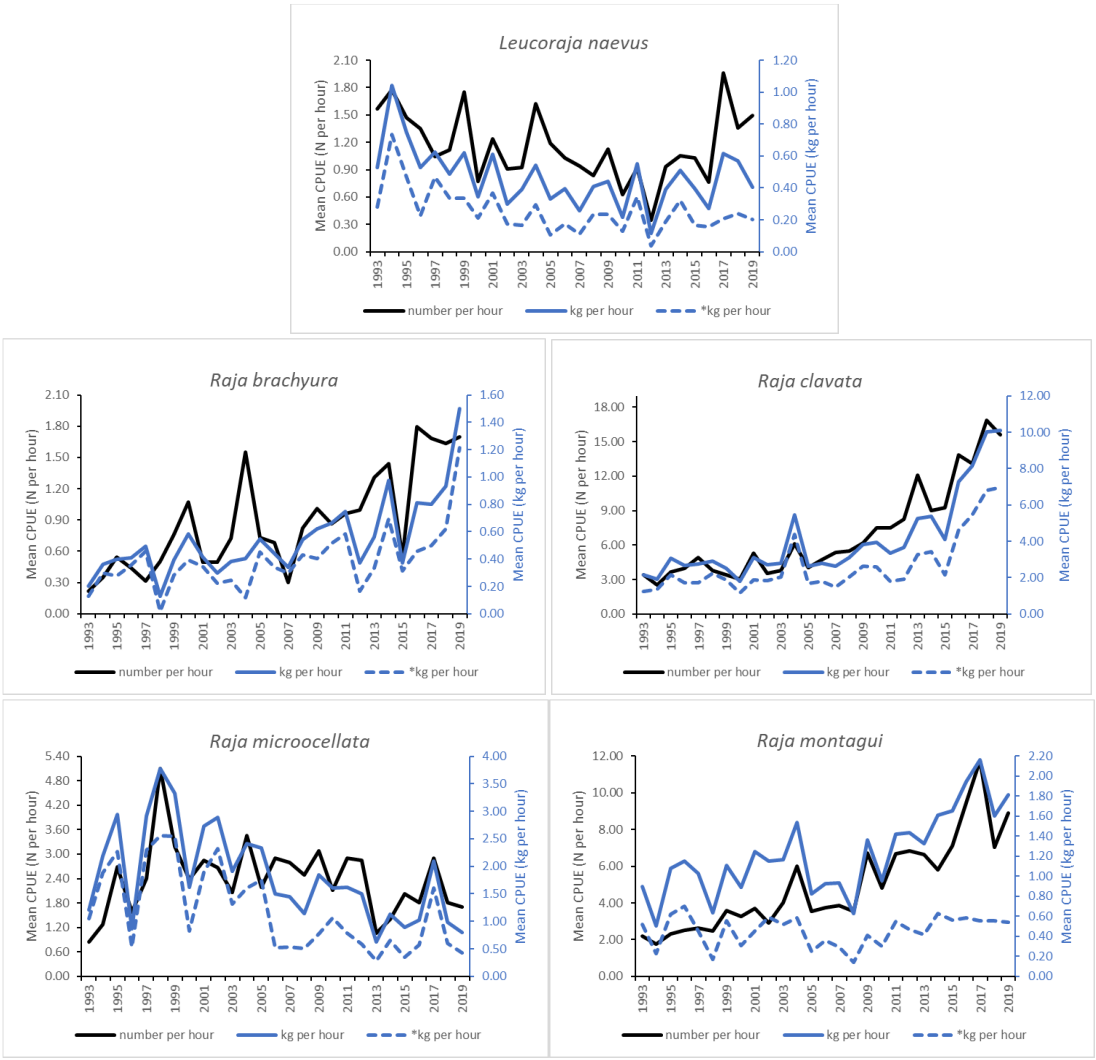

Figure 18.6. Skates and rays in the Celtic Seas. Temporal trends (1993–2019) in the CPUE by individuals (n.h^{-1}; solid black line), biomass (kg h^{-1}; solid blue line), and biomass for individuals ≥50 cm total length (kg h^{-1}; dashed blue line) of skates in the 7.a.f–g beam trawl survey (EngW-BTS-Q3; Source: WD04 - Silva and Ellis, 2020).

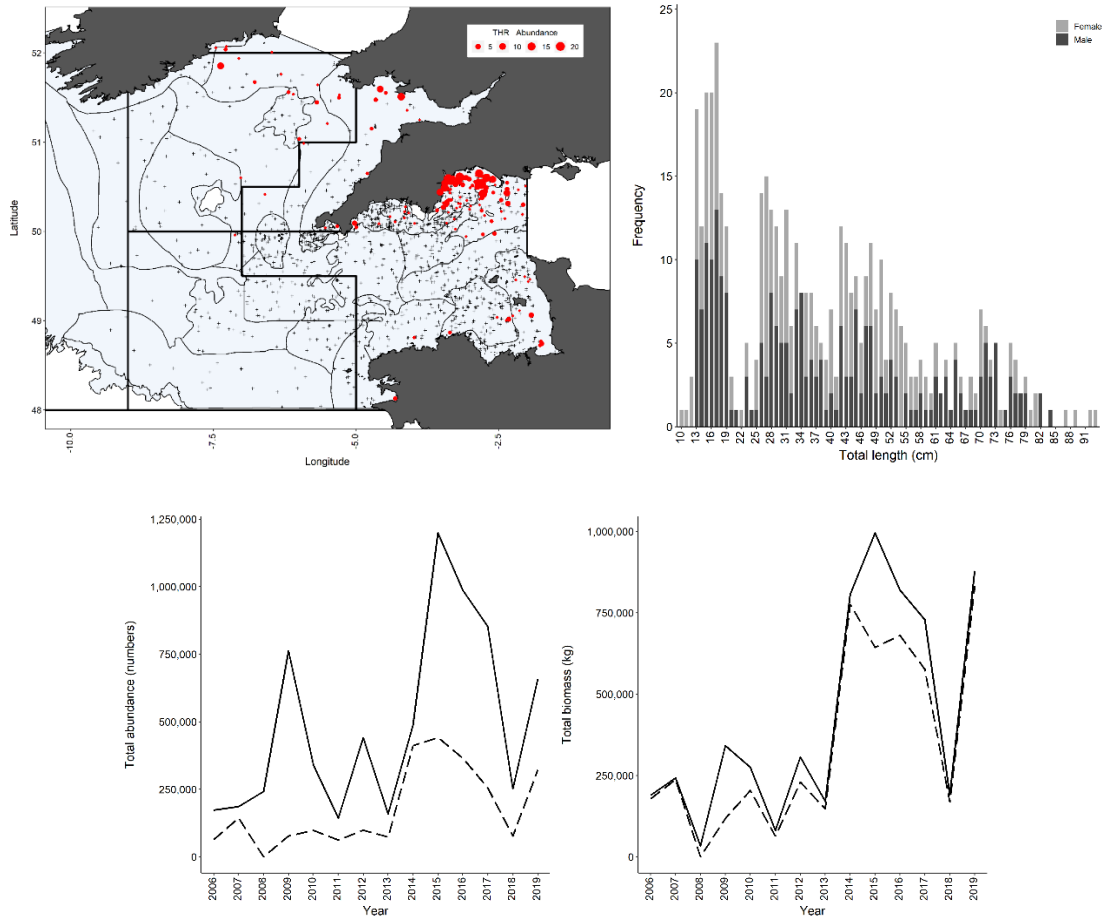

Figure 18.7a. Skates in the Celtic Sea. Distribution and relative abundance (top left) and length-frequency by sex (top right) of thornback ray *Raja clavata* in the Q1SWECOS trawl survey. Preliminary estimates of total abundance (numbers) and biomass (kg) - continuous line relates to all specimens, dashed line relates to individuals ≥50 cm total length. (Source: WD05 - Silva *et al.,* 2020)

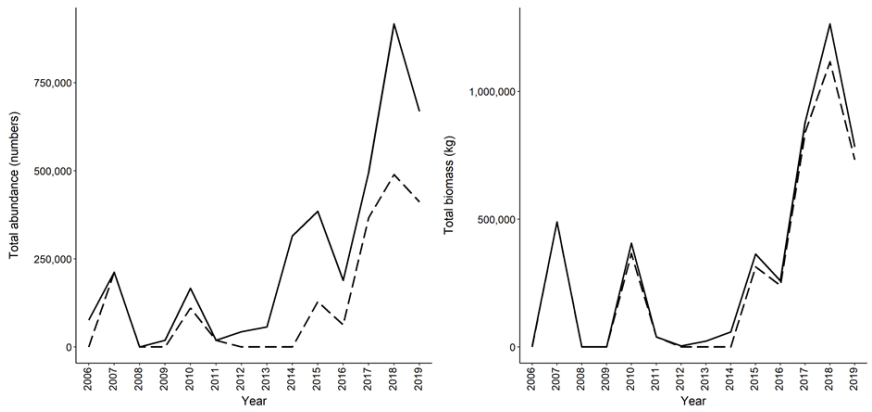

Figure 18.7b. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers) and total biomass (kg) for common skate *Dipturus batis*-complex. Continuous line relates to all specimens, dashed line relates to individuals ≥50 cm total length. (Source: WD05 - Silva *et al.,* 2020).

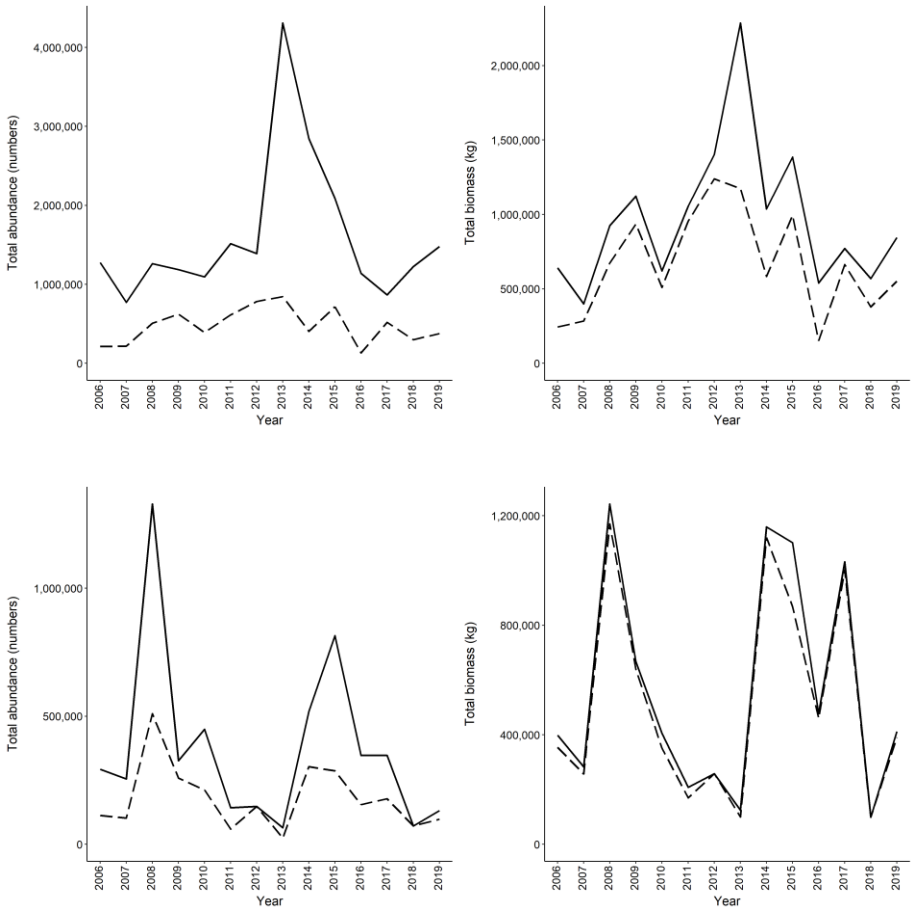

Figure 18.7c. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers) and total biomass (kg) for (top) cuckoo ray *Leucoraja naevus* and (bottom) blonde ray *Raja brachyura*. Continuous line relates to all specimens, dashed line relates to individuals ≥50 cm total length. (Source: WD05 - Silva *et al.,* 2020).

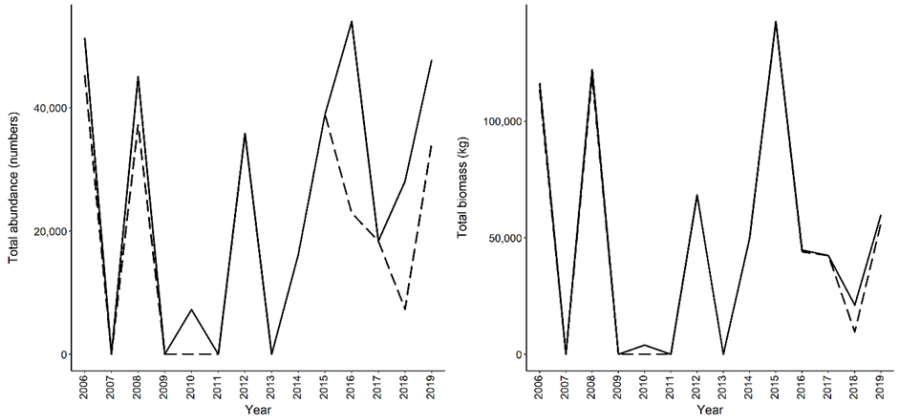

Figure 18.7d. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers) and total biomass (kg) for small-eyed ray *Raja microocellata*. Continuous line relates to all specimens, dashed line relates to individuals ≥50 cm total length. (Source: WD05 - Silva *et al.,* 2020).

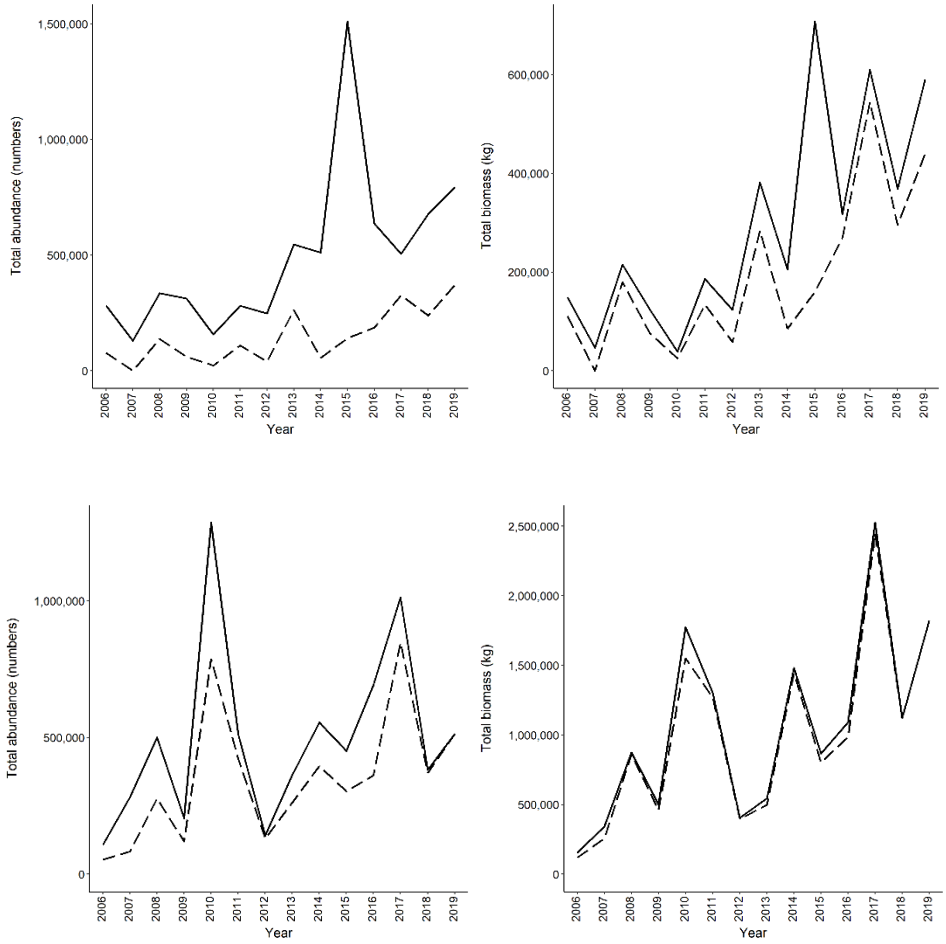

Figure 18.7e. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers) and total biomass (kg) for (top) spotted ray *Raja montagui* and (bottom) undulate ray *Raja undulata*. Continuous line relates to all specimens, dashed line relates to individuals ≥50 cm total length. (Source: WD05 - Silva *et al.,* 2020)

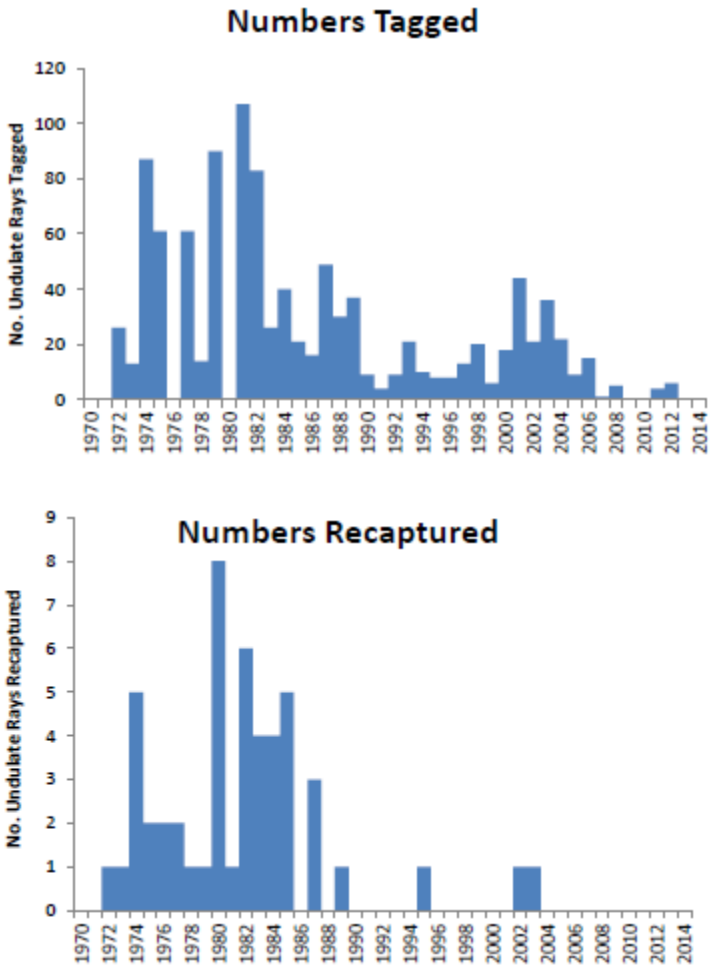

Figure 18.8. Skates in the Celtic Seas. Numbers of *Raja undulata* tagged (top) and recaptured (bottom) in Tralee Bay and surroundings, 1970–2014. Source: Wögerbauer *et al.*, 2014 WD.